1796

Health for You

THIRD EDITION

★ CRISP

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Mrs. Crisp formerly was a member of East High School, Denver, Colorado. This third edition was prepared by Evelyn G. Jones, Denver Public Schools. The 1946 and 1949 revisions were prepared by Helen A. Burnham and Evelyn G. Jones, Denver Public Schools.

***Health for You* is a production of the Department of Instruction of the Denver Public Schools.**

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Preface

Health for You is a complete revision of the textbook *Be Healthy,* written by Katharine Bruderlin Crisp and published in 1938 under the direction of the Department of Research and Curriculum and the Department of Health Education of the Denver Public Schools.

In writing this new book, *Health for You,* the author has retained and utilized all of the valuable features which contributed to the widespread use of *Be Healthy* throughout the high schools of the nation. The directness and clarity of style of the writing cannot fail to make the new volume appeal to high school students. The accuracy of technique displayed in the numerous pen-and-ink drawings is especially helpful in enabling students to acquire correct information concerning the many phases of health. Photographs have been chosen carefully to supplement descriptions and emphasize statements presented in the text. This successor to the previous textbook, *Be Healthy,* contains many additional up-to-the-minute features which make the book modern in every respect.

Health has for many years been recognized as a major first objective of secondary education. Health instruction has been organized in various ways by different teachers. One customary and more or less effective way is to set aside each week a stated number of school periods to direct instruction in the subject of health. Then we find also an indirect approach in which teachers of the various subject-matter areas utilize many opportunities for students to learn and practice health rules as the occasion arises in their daily experiences. In many schools the aim is to have every teacher a teacher of health. Some programs in the same building provide for both approaches. *Health for You* is written and so organized as to serve the purpose of a textbook or a reference volume in the field of health education and is adapted for use with any method of instruction employed.

The first three sections of the book are given over to a discussion of personal health, the phase of health which is of chief concern to most high school students. Section 4 deals with community health and Section 5 with safety.

Health is a vital factor in the experience of every individual. For this reason schools are justified in limiting instruction to those matters of immediate significance to the youth in any instructional group. The criterion of a successful health instruction program is whether or not it enables the student to practice healthful living. The material herein recognizes this fact by indicating that knowledge of health is an important item but that knowledge alone is of little value if not practiced. Through the use of the book *Health for You* students will be provided with a technical background that will enable them to develop an understanding of the means of improving and maintaining health.

The contents have been checked for accuracy with medical authorities and with the most recent writings in the field of health. Positive statements are limited to those subjects upon which there seems to be general agreement. Technical information has been included only where such facts are essential to a more complete understanding of the major phases of healthful living.

The material in *Health for You* is arranged according to the following plan:

At the beginning of each chapter are *questions* which pupils have often asked about health. The answers to any particular group of questions will be found within the chapter. The health habits, knowledges, and attitudes that pupils should have before leaving high school are also stated. A concluding statement of one paragraph completes this part of the chapter. This is followed by *activities* and by one or more *tests* that will aid in estimating an understanding of the chapter.

Near the close of each chapter associated-subject departments are listed, and their relationship to the topic of the chapter is given.

At the end of the chapter is given a list of supplemental films and reference books which will be found valuable in explaining the material presented in the chapter.

In addition to the persons named opposite the title page, valuable criticisms were also received from the following persons who read the portions of the manuscript dealing with their respective fields: B. Irene Bradley, M.D., and George K. Cotton, M.D. (now deceased), Examining Physicians; A. J. Markley, M.D., Dermatologist; Edward R. Muggrage, M.D., Professor of Clinical Pathology; Robert C. Lewis, Ph.D., Professor of Biochemistry; and Philip Work, M.D., Acting Head of the Department of Neurology—all from the School of Medicine, University of Colorado; and Max Giesecke, Dentist. The X-ray photographs were furnished by Frank B. Stephenson, M.D., Roentgenologist, and Ira C. Brownlie, Dental Radiologist.

The line drawings are the work of Waneeta Stevic.

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What's New in Health?

Young people today find themselves in an advantageous position for healthful and happy living. They have the benefit of scientific advances that would have seemed incredible to their great grandparents who accepted many illnesses as inevitable. However, these benefits do not accrue automatically. Individuals must become intelligent and responsible consumers if they are to make the greatest use of new knowledge and practices in the care of health. They must become informed citizens if they are to understand and support community provisions for the welfare of everyone. It is worth while, then, to begin the study about health with an overview of some of the recent progress that has been made.

Department of Health, Education, and Welfare. The Federal government of the United States had, as early as June, 1798, established an agency concerned with the health of its seamen. As the population increased and problems became more numerous and more complex, new agencies were formed to protect the health of all citizens. These were located in various departments where they seemed to be functional, and co-ordination of their work became difficult as time elapsed.

In April, 1953, health of citizens was given greater status by President Dwight Eisenhower with the establishment of the Department of Health, Education, and Welfare, with a Secretary in the Cabinet. Many agencies, such as the Social Security Administration, Children's Bureau, Public Health Service, and Office of Education were combined in the new department. This will make possible greater efficiency in promoting health.

World Health Organization. The specialized agency of United Nations, WHO, is the one directing and co-ordinating authority in international health work. Its membership includes eighty-two countries dedicated to helping each other to help themselves in raising health standards. Advisory services are furnished by WHO through public health experts, demonstration teams for disease control, visiting specialists, and consultants. Teams go into a country to demonstrate methods and teach the citizens how to strengthen and improve their own health services.

WHO has helped in control of communicable diseases, is promoting interest in preventive medicine, and is emphasizing the training of public health personnel.

There are six regional offices located in Brazzaville, for Africa; Washington, for the Americans; New Delhi, for southeast Asia; Geneva, for Europe; Alexandria, for the eastern Mediterranean area; and Manila for the western Pacific area.

Courtesy Ewing Galloway

WHO is helping Indonesia to attack the problem of yaws which affects 15 percent of the population. Doctors are trained and medicines supplied.

Health councils. A promising and growing practice is the formation of local, unofficial health councils. These councils vary in their membership but usually have representatives of all agencies that are concerned with phases of health.

School health councils include the principal, school physician, school nurse, lunchroom manager, custodian, several pupils, parents, and teachers. Meetings of this group become a clearing house for all health problems in the school environment and among the school population.

City health councils include representatives of official agencies and volunteer health organizations. Plans are made for needed projects, and duplication of effort is avoided. In 1953 there were 1,564 community health bodies listed in the current directory of

Courtesy Ewing Galloway

MODERN METHODS of health care are reaching Navajo Indian reservations. There is need for health education in the United States as well as in remote parts of the world.

such organizations in the United States, an increase of 30 percent over the number in the 1950 directory. There were, also, thirty-four state health councils.

These developments all represent concerted, intelligent effort to improve environment, provide varied health services, and educate the citizens to take better care of themselves.

The general practitioner. In an age of specialization when many physicians have confined their practice to the care of one type of disease, there is now a trend toward the general practitioner or "family doctor." Medical schools are encouraging students to prepare themselves for a general practice. Physicians who have practiced for years are offered refresher courses in order that they may be familiar with all areas of medicine.

This new trend is an outcome of a growing appreciation of the value of the human touch in the relationship between physician and patient. The doctor who knows a person well and is familiar with his background and personal problems can treat his illnesses more intelligently. A personal physician can determine when the services of a specialist are needed and can secure the proper one.

Research. Funds collected by national organizations and grants from foundations have supported research that is solving many health problems. Solutions to others seem to be possible in a short time as new measures are in the experimental and developmental stages.

Courtesy Ewing Galloway

RESEARCH finds the causes of disease. New methods of treatment developed in laboratories are abolishing some kinds of illness.

Surgery. New surgical operations are restoring to health many cases that until recent years were thought to be hopeless. Most dramatic among the new procedures are operations which have been developed in the last fifteen years on the heart and blood vessels.

"Banks" in which are preserved arteries and bones are available in many hospitals. Pieces of healthy artery or bone are taken from accident victims at death and preserved so that they may be used later by surgeons in repairing diseased or damaged parts.

Blood as a medicine. Transfusions of whole blood and blood plasma have been used for many years to replace blood lost through excessive bleeding and for treatment of shock. Transfusions now are being used for patients undergoing surgery, for persons with anemia, and in treatment of severely burned patients. There are now 1,500 blood banks in the United States, and more than 900 cities have either a blood bank or a Red Cross regional blood center, or both.

Derivatives obtained from blood plasma are now furnishing some of the most valuable medicines. Among these fractions are *serum albumin* for emergency treatment of shock; *thrombin-*

fibrin film and *foam* which help to stop bleeding during surgery; and *antihemophilic globulin* which helps hereditary bleeders. *Gamma globulin* another derivative, is the part of blood that contains disease-fighting antibodies. It has been used for prevention and treatment of measles. It now is used for temporary protection against paralysis of poliomyelitis. Injections of gamma globulin provide protection for five or six weeks and offer the greatest hope against this crippling disease until a vaccine is available.

Courtesy Ewing Galloway

EXPERIMENTS with molds are developing many new medicines to combat infections. These medicines are called antibiotics.

Tuberculosis. Great strides are being made in the cure of tuberculosis, a disease for which, until recently, there was no treatment except a long period of rest in a sanatorium. New medicines are now being used, together with surgery in some cases, with the result that the death rate has dropped to 22.5 per 100,000.

Incidence of tuberculosis remains high, however, although cures are increasing. There still is need of education so that people will realize the importance of maintaining good physical condition for resistance and good habits of personal hygiene to avoid infection.

Early discovery of the presence of tuberculosis helps to make its cure possible. Emphasis is shifting from mass chest X-ray surveys for discovering cases to selective surveys among special groups, such as admissions to general hospitals, old-age and relief clients, and family contacts of known cases. In these programs three or four times as many cases are found as are discovered among the same numbers in the general population.

There are problems as well as progress. While the great progress that has been made in care of health is a source of satisfaction to everyone, there remain a number of problems that are of particular concern at the present time. These are a challenge to young people to help in their solution.

Safety. Accidents caused the deaths of 94,000 and injured 9,400,000 in the United States in 1951. In fact, accidents are the leading causes of child deaths. More people have died from automobile accidents in the fifty-two years since the first person was killed by a motorcar than from all the wars in which we have participated. But accidents at home and in industry also are serious problems. Industrial accidents during 1951 were 9 percent more than 1950.

Elimination of hazards in the environment has increasing attention. House planning and construction and industrial engineering are becoming sciences in which safety factors are given major emphasis.

Safety experts now are realizing that a relatively small percent of people in any group have a large proportion of the accidents. There are potential characteristics within some individuals that predispose them to have accidents. This is a problem of mental health and education that must be solved if safety programs are to succeed.

Mental health. Health, in the past, usually meant the absence of physical illness or pain. Today the term has a broader meaning. The World Health Organization defines health as a state of complete physical, mental, and social well-being. This newer concept has turned attention to the problems of achieving mental health which is, in turn, more than the absence of mental illness. Feelings of security, happiness, and satisfaction with one's role in life are recognized as basic qualities for mental health. This has turned the attention of physicians, educators, and parents to a study of child growth and development so that normal behavior

Courtesy Ewing Galloway

NEW HOUSING projects are built with safety, ventilation, and sanitation as prime factors in the planning.

may be understood and deviations recognized. There is need of more research in this area before problems of unhappiness and delinquency can be solved.

Consumer protection. One would think that health is a commodity that can be advertised and sold, judging by the sums that are spent for promotion of health products on television and radio programs and in the press. Waste of money in this way by the seller and by the purchaser who does not get health value in return is regrettable. More tragic are the disappointment and suffering that follow the use of worthless or unsafe products.

Regulation of the claims made in advertising is far below desirable standards. There still are permitted false claims for cancer cures and for exaggerated benefits from products containing substances such as chlorophyll or vitamins. An informed public must demand protection by legislation.

There is a tendency to rely too much upon the Federal Food, Drug, and Cosmetic Act for protection. Citizens forget that this law controls only products that enter interstate commerce. Every

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Courtesy Denver Public Schools

Your Health and Personal Appearanc

state must regulate the drugs manufactured and sold within its boundaries. Less than half of the states have food and drug laws uniform with the federal law. Some states have no drug laws at all, and in many states provisions for enforcement of existing laws are inadequate. There is need of more trained personnel for inspection.

Overweight. Physicians recognize overweight as one of the most widespread health problems in the United States today. The abundance and variety of foods available tempt people to eat more food than is necessary to supply their needs. It is believed that simple measures of weight control could reduce the number of people who die from diseases of the heart and arteries and from diabetes. While many young people do not have this problem, all should realize that this condition is a hazard to health as well as to personal appearance. It is easier to avoid than to overcome excess weight.

Recent studies about obesity indicate that it is often an emotional problem. Persons who feel insecure may find satisfaction in eating. Boys and girls at college, away from home for the first time, or persons with new jobs find that food satisfies feelings of loneliness or inadequacy. The persons are not conscious that they are eating more food or of the reason why they do, but habits are formed that are difficult to change when the overweight condition is recognized.

Health is not only a personal problem, intimately concerned with the way an individual feels. It is an economic problem, affecting the ability to earn a living, and a social problem, affecting the welfare of every citizen. Science is continually changing the picture as new understanding of the human body and personality is achieved and new methods for prevention and care of illness are developed.

1. YOUR HEALTH IS IN YOUR HANDS

YOUR body is your own. It is the only body you will ever have. What do you propose to do with it? If you mistreat it, you cannot turn it in for a new and improved model. There are no yearly models. Your body is your one and only model. It is changing constantly. Do you know how to make the most of this body that is yours?

Your own body is different from the body of any other person. It may have been strong in the beginning, or it may have been weak. But whatever your start in life, it is only by correct living that you can attain your maximum of health, happiness, and service to others.

By the time you have reached high school, certain habits of eating, exercising, and sleeping have been fairly well established. Some of these habits may not be good and may need changing. Young people by no means always make the most of their opportunities for developing healthy bodies. As to health, your present habits form an important basis for later life. Physical examinations of men for military service reveal many defects which might have been prevented or overcome through healthful living.

If you are ordinarily a robust person, you rarely think about your health until you experience illness or an accident. Then you look for the quickest way to overcome the difficulty.

Do you know . . .

1. What ways of living promote health?
2. What health goals you may expect to attain for yourself?
3. Why you ought to establish good health habits during school years?
4. Why you are individually responsible for your health?
5. Why mental health is so important?
6. What is the foundation of medical research?
7. Some of the achievements of modern medicine?
8. How long you may expect to live?
9. How the findings of the physical examinations of men for military service may be useful in promoting health?

Parts of your body. Like an automobile, your body is made up of many parts. Some of these which have special duties are called organs. Such organs as the stomach, heart, and lungs work together in keeping your body alive and growing. Other organs make you safe and comfortable and keep you adjusted to your surroundings. These are receiving organs that make you aware of the world about you. Eyes, ears, tongue, nose, and skin pick up signals from the outside world. The messages are carried over a connecting set of nerves to the brain.

Your behavior. What you do and how you act depend on how you feel or think (conditions within the body) and your reactions to influences outside the body. The way you feel is important in your reaction to those about you and the impression you make on others. For example, when you go to the table hungry, you ordinarily eat heartily. But if you are concerned about making a good impression upon your guests, you may eat with more restraint and with less satisfaction.

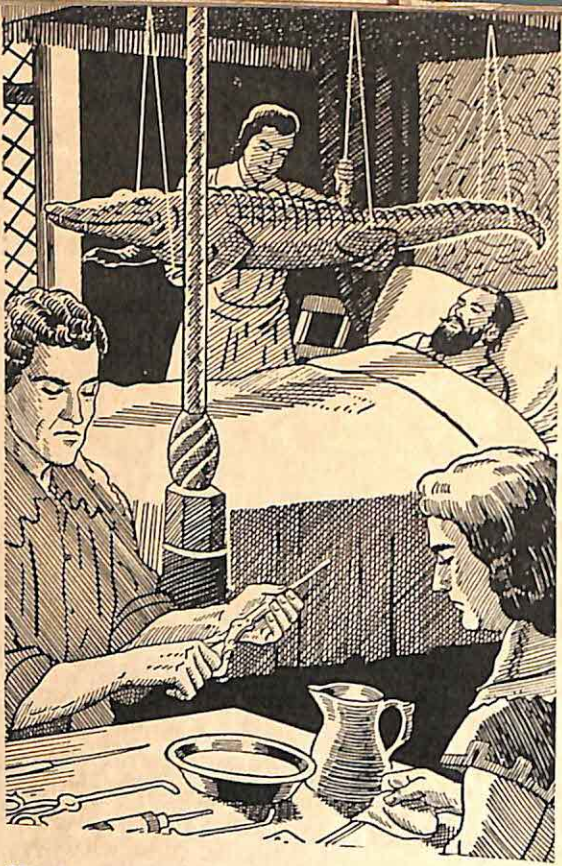
Your personal adjustments. If you make friends easily and get along with people, you may seldom or never give attention to your personality until you find difficulty in adjusting yourself to a personal situation. Then you need to find a way of solving the problem. Up to a certain point it is proper not to worry about your health or to be concerned about being popular among your acquaintances. But you ought to learn to live to the fullest degree consistent with the health and happiness of yourself and others. Your happiness and success have their roots in physical and mental health.

In the changing circumstances of life none of us can expect to find full satisfaction of desires or ambitions. What we must constantly seek is to make the most of conditions in which we are placed.

Goals to attain. It is not necessary, or possible, for every boy to become a football star or for every girl to become a tennis champion. Nearly every boy and girl, however, can have:

An upright body which gives him or her the appearance of having a purpose in life.

A clear skin and a healthy appearance.



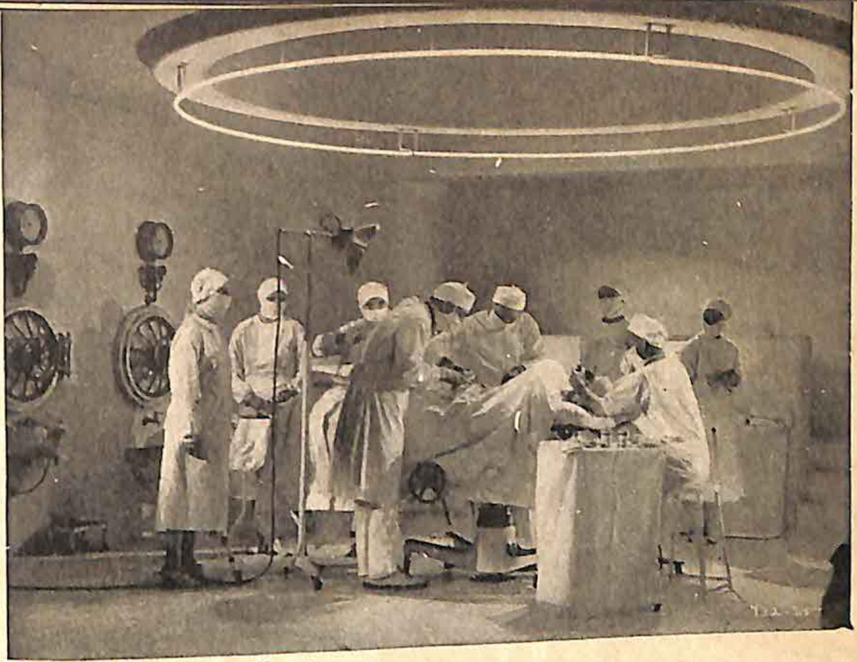
Courtesy American Can Company

IN EARLY days barbers also acted as surgeons. A stuffed animal, usually an alligator, was suspended over the patient who was being operated on. It was believed this would keep away evil spirits. Contrast the equipment, lighting, and sanitary precautions with those shown in the picture on the opposite page.

Vitality enough to enjoy work and play to the fullest.
Strength and agility sufficient to play one or more games fairly well.
Knowledge of how to prevent sickness and disease, and ability to care for oneself when illness cannot be avoided.
Confidence and enthusiasm for the day's work.

While you are in high school, you should try to find out all you can about these things. Your teachers cannot make you healthy, but they can help you attain and keep health by showing you how to reach the health goals you have set for yourself. They can teach you many facts about healthful living, but they cannot, day in and day out, make you practice what is taught. *Yours is the major responsibility.*

The purpose of this book. The purpose of this book is to awaken your interest in the care and use of your own body. This book will point out certain ways of living that, if observed, will contribute to your pleasure and happiness and will make you proud to have a sound mind in a healthy body.



Courtesy Metro-Goldwyn-Mayer

IN THE MODERN operating room everything is done to make the operation safe and successful. The patient lies on the operating table while the surgeons are skillfully using the instruments to perform the operation. The physicians and nurses have their mouths and nostrils covered with gauze masks, their hands with rubber gloves. They themselves are covered with clean white clothing, all of which has been sterilized.

The discussion of certain diseases is not intended to frighten you but to do away with mistaken and superstitious beliefs in the treatment of ill health and disease. Those in charge of health-teaching believe that through an understanding of the problems relating to disease a sense of security can be established that will overcome fear.

History of medicine. Progress in the field of health has worked toward the prevention and cure of disease, the lessening of human suffering, and the prolongation of life. A brief survey of some of the outstanding achievements in medical research will give us a better appreciation of the knowledge that is ours today.

The art of medicine began in mystery and superstition; its progress has been retarded by ignorance and quackery. Medical knowledge has grown with steady advance in the fields of physics, chemistry, and biology; for these are the basic sciences upon which medicine is based.

Up to the beginning of the 1800's little progress was made in scientific research. However, there had been important discoveries and inventions which paved the way for later investigations. Among these were the microscope, the circulation of the blood, and the value of vaccination.

Progress in health. The modern era in medicine began well after the middle of the 1800's with the discovery of bacteria as causes of infection. During the past seventy-five years medical science has advanced much more rapidly than ever before. Progress in knowledge and practice has been based upon accurate scientific observation and experiments. During this period many fundamental principles that control modern medicine have been formulated.

The germ theory of disease and the cell theory of the structure of organisms (the latter firmly established by 1838) served as the bases for further experimentation. Modern surgery was made possible by the use of anesthetics and aseptic methods. Preventive medicine began with the work of Pasteur and Koch. Such diseases as tuberculosis, diphtheria, typhoid fever, and malaria can now be prevented. It has been found that under certain conditions the human body can produce substances which attack germs or neutralize their poisons; in other words, the human body can acquire immunity to some diseases. The discovery and use of vaccines, antitoxins, and antiserums, and the knowledge and practice of sanitation, have virtually banished some of man's most ancient and fearful enemies in the world of disease. At the close of the 1800's came the discovery of the mode of transmission of yellow fever and other insect-borne diseases.

Applying our knowledge of medical science. There is often a great lapse between discovery and application. A large part of medical progress in the 1900's has been in wider acceptance, application, and development of the revolutionary discoveries of the 1800's. But the 1900's can also claim new discoveries.

The proof that certain glands (endocrine glands) in the body produce chemical substances which, on entering the circulation, influence the activity of one or more organs is of recent origin. A number of these substances, known as *hormones*, have been discovered and their functions established (see p. 295). Isolation of insulin, the hormone secreted by the pancreas, has brought relief to many sufferers from diabetes.

Courtesy Warner Brothers

LOUIS PASTEUR (1822-1895) developed the germ theory of disease and advanced medical science more than any other man. This photograph is from the moving picture which was based upon the life story of Pasteur.

Important facts in the relation of diet to normal growth and to the development of resistance to disease have been established. The discovery of *vitamins* and of their action in the promotion of normal bodily functions (see p. 162) afforded a new basis for food selection. All vitamins seem to be interrelated so that one does not perform its functions in the absense of others. Scientists believe that there may be many more vitamins or other nutrients not yet identified.

Recent studies have further emphasized the need for certain mineral salts in the bodily processes and in the reproduction and development of young animals. Prolonged undersupply of certain minerals may result in such disorders as anemia and bone malformations.

The X ray and radium are now being applied widely to the treatment of disease. Difficult and prolonged surgical operations are frequently made possible by the use of certain new chemical substances known as *anesthetics*. Plastic surgery, or the reconstruction of disfigured parts of the face and other regions of the body, has developed greatly since there have been war injuries.

In the presence of a foreign protein, the body often reacts by developing a rash, hives, fever, sneezing, or other disturbance. These reactions are due to an exaggerated sensitivity which occurs in some persons more than in others, and the condition is now called *allergy*. Many conditions, such as asthma and hay fever,

Courtesy U. S. Public Health Service

IN ADDITION to the discovery of effective anesthetics, modern science has invented a machine for administering an anesthetic safely.

are now being treated successfully upon the basis of a study of allergy in the individual concerned.

Applying our knowledge of mental hygiene. Preventive medicine recognizes today that there are also mental factors which interfere with the successful adjustment of the individual to his surroundings. Mental hygiene, through the study of factors which make for mental balance, strives to prevent those failures of adjustment which impair personal efficiency and happiness. Furthermore, the scientific study of mental health promises much in the prevention or cure of those emotional upsets which border upon, or actually lead to, insanity.

Life expectancy today. The average length of life after any given age is spoken of as "expectation," and insurance calculations are based on expectation of life. During the last generation twenty years have been added to the life expectation at birth of the average American, who today can expect to live almost sixty-seven years. This has been due to great extent to cuts in the infant mortality rate and to many discoveries for prevention and cure of communicable diseases. In 1850 a person who survived the age of thirty-five might hope to live almost another twenty-five years. Today life expectancy at this age is almost another thirty-seven years. As more people live longer, there is a resulting serious increase in disease of middle and old age, such as heart disease, cancer, and cerebral hemorrhage. Examine the table on page 304 to note the changes in rates of death from these diseases. Science has yet to cope with the maladies more or less peculiar to the second half of life.

New investigations in the science of health will lead to new discoveries beyond the conception of persons now living. Answers will be found for riddles yet unsolved.

In conclusion

EVERYONE ought to be reasonably familiar with the achievements of medical science in the prevention and cure of disease. But no one should suppose that for maintenance of good health it is sufficient to live as he pleases and then resort to physicians and medicines when something goes wrong. Intelligent understanding of the functions and needs of the human body with regard to food, rest, work, and play, and conformity to the principles based upon such understanding, are of prime importance. Correct living is the basis of good health. It is hoped that this book will help students to apply in their own daily lives the principles of correct living.

Activities

1. Check your knowledge. Now that you have read the chapter carefully, can you answer the questions on page 2? If not, carefully reread the parts necessary for a better understanding. Other questions which are not dealt with may have occurred to you. It may then be necessary for you to read other references.

[*To check your knowledge at the close of each chapter, use this same method of review.*]

2. Make a list of current superstitions. How may belief in such superstitions interfere with being healthy?

3. Prepare a list of goals for self-improvement. From this list select one or more that you desire to attain, and formulate a plan of self-improvement.

4. Visit a hospital to study its equipment and prepare a report for the class.

5. Show how the expectation of life has increased since 1850. Obtain statistics from a life insurance company.

6. Begin a collection of current articles on health and personal development.

7. Select for further study one of the scientific discoveries mentioned in this chapter.

Test

Directions: There are five incomplete statements in this test, (A, B, C, D, and E), each followed by a varying number of parts. One or more of these parts correctly completes the incomplete statement. On a separate sheet of paper copy the five letters and the numbers of their parts in a vertical column. Place a plus sign (+) after the number of each part that correctly completes the statement. Do not write in the book.

A. Maximum health for the individual may be attained
  1. by studying the principles governing bodily health.
  2. by imitating the behavior of older persons.
  3. by daily practice of the laws of health.
  4. by consulting a physician.

B. Modern surgery has made rapid progress because of
  1. the use of the microscope.
  2. many hospitals.
  3. the use of anesthetics.
  4. aseptic methods.
  5. well-trained nurses.

C. The modern era of medicine began with
  1. the discovery of bacteria.
  2. the invention of the stethoscope.
  3. the use of x ray.
  4. the discovery of vitamins.

D. Recent developments in the science of health are
  1. the discovery of the cause of tuberculosis.
  2. the knowledge of allergy.
  3. plastic surgery.

4. the use of medicinal herbs.
5. the isolation of insulin.

E. Your expectation of life at birth was
   1. 12 yrs.
   2. 35 yrs.
   3. 60 yrs.
   4. 72 yrs.

Associated subjects

Biology: Scientific discovery in the special fields. . . . Contributions of biologists to the advancement of medicine.

Chemistry: Chemicals used in medicine. . . . Chemistry of anesthetics and antiseptics.

Physical education: Physical examination. . . . Exercise for physical fitness. . . . Correction of remediable defects.

Psychology: Mental hygiene. . . . Emotional reaction. . . . Behavior and self-expression.

Social science: Community provisions for public health and welfare.

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WILLIAMS. *Healthful Living.*

Films

Body Fights Disease. 15 minutes, sound. McGraw-Hill.
Cancer—Traitor Within. 10 minutes, sound, color. American Cancer Society.
Industry for Health. 30 minutes, sound. Upjohn Company.
Man Against Microbe. 10 minutes, sound. Metropolitan Life Insurance Company.
Modern Guide to Health. 10 minutes, sound. Young America.
The Doctor. 10 minutes, sound. Encyclopaedia Britannica.

(Complete information about books and films listed at the end of the chapters is given in the back of the book.)

2. AN ERECT BODY IS A WELL-BALANCED BODY

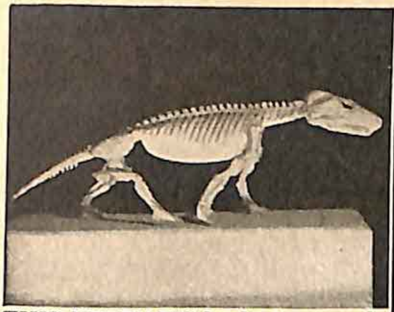
A WELL-DEVELOPED body and graceful carriage are admired by everyone. Observe the person who carries himself well, and you will note that he has good posture. A well-balanced body depends upon symmetrical development of the muscles which hold the body erect and in proper alignment. Grace of movement is related to correct use of these muscles.

The shape of your body depends upon its framework and muscular development. The weight of your head, shoulders, and chest has to be balanced on the length and breadth of your two feet and sometimes only on one foot. If the strain of the movements of all the bodily parts is thrown habitually in the wrong direction, the body gradually sags and bends out of shape. The body can only get its best development if every part is in its right place and works together with every other part. At the same time each movement will strengthen the muscles that keep the body erect.

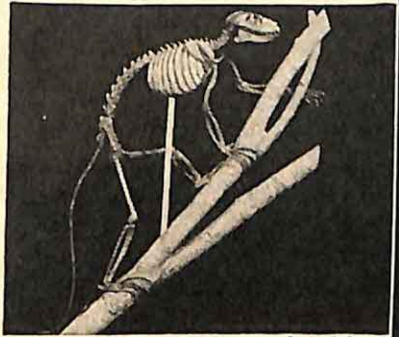
You should find out how your own body is lined up and then apply the right technique to your daily movements.

Do you know . . .

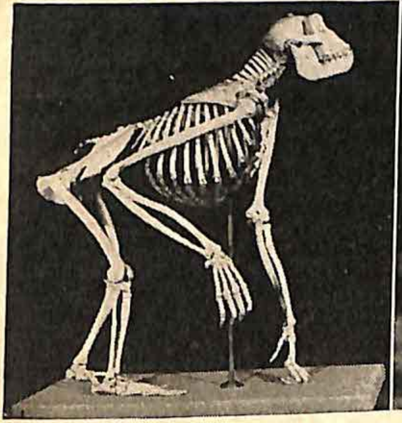
1. Why carriage is related to posture?
2. How correct posture can be determined?
3. Why bones are important in posture?
4. How bones are held together?
5. How movement between bones is brought about?
6. What "double joints" are?
7. How poor carriage causes fatigue?
8. That because man is a two-legged animal gravity makes it more difficult to maintain correct posture?
9. How poor posture can be improved?
10. How posture is related to health?
11. That bones are made of living material?
12. How bones are kept smooth at the joints?
13. What causes some bones to break easily?
14. Why bones are more flexible in young persons than in older persons?



THIS REPTILE'S body is raised on four legs.

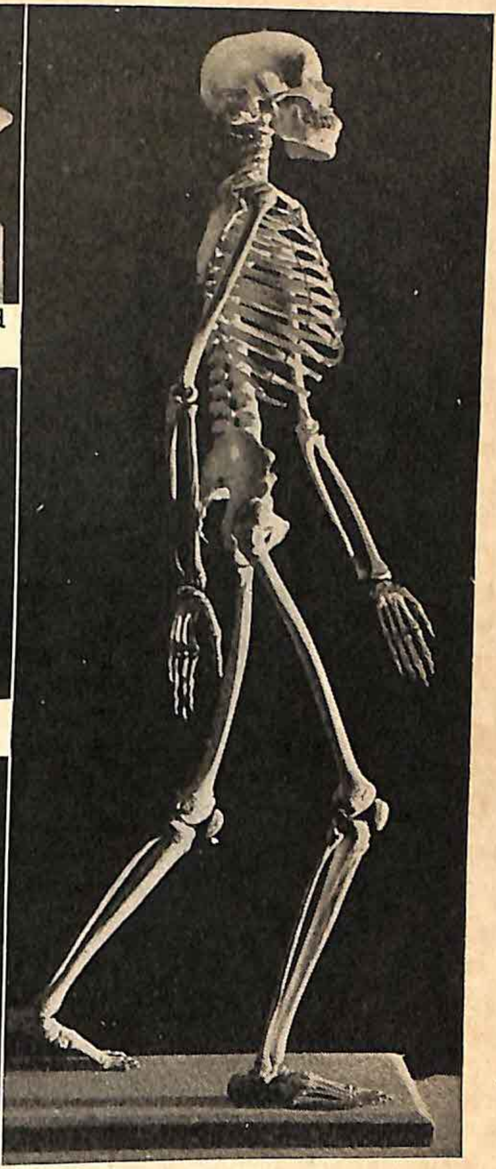


THE LIMBS of this monkeylike animal suggest arms and legs.

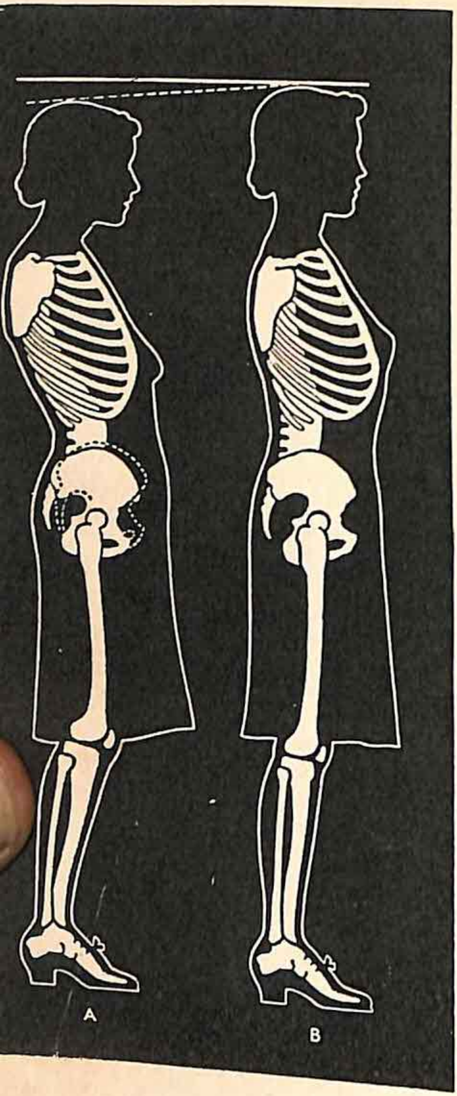


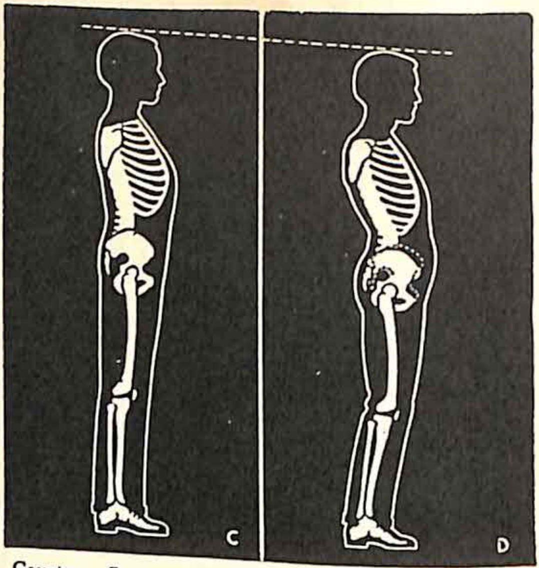
Courtesy Pictures, Inc.

A SEMIERECT chimpanzee walks on hind legs but leans on his arms.



MAN is the only animal that can walk upright without leaning on his arms.



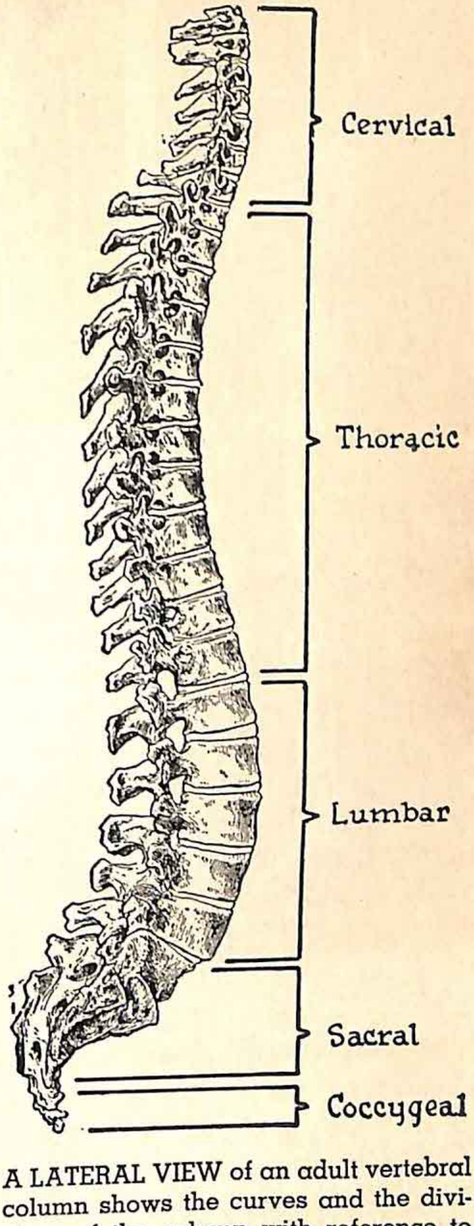


Courtesy Samuel Higby Camp Institute for Better Posture, New York City

THE PULL of gravity on the body is a continual hindrance to good posture. The bones support the body, and the muscles co-operate with them to keep the body erect or in any position we may wish to take. In *A* and *B* we see the change from poor to good posture; in *C* and *D*, from good to poor. In good posture the head is held high, with chin in, the shoulder blades are flat, the chest up and forward, the abdomen up and in, the lower back flattened, the hips tilted down in back, and the knees straight but not stiff.

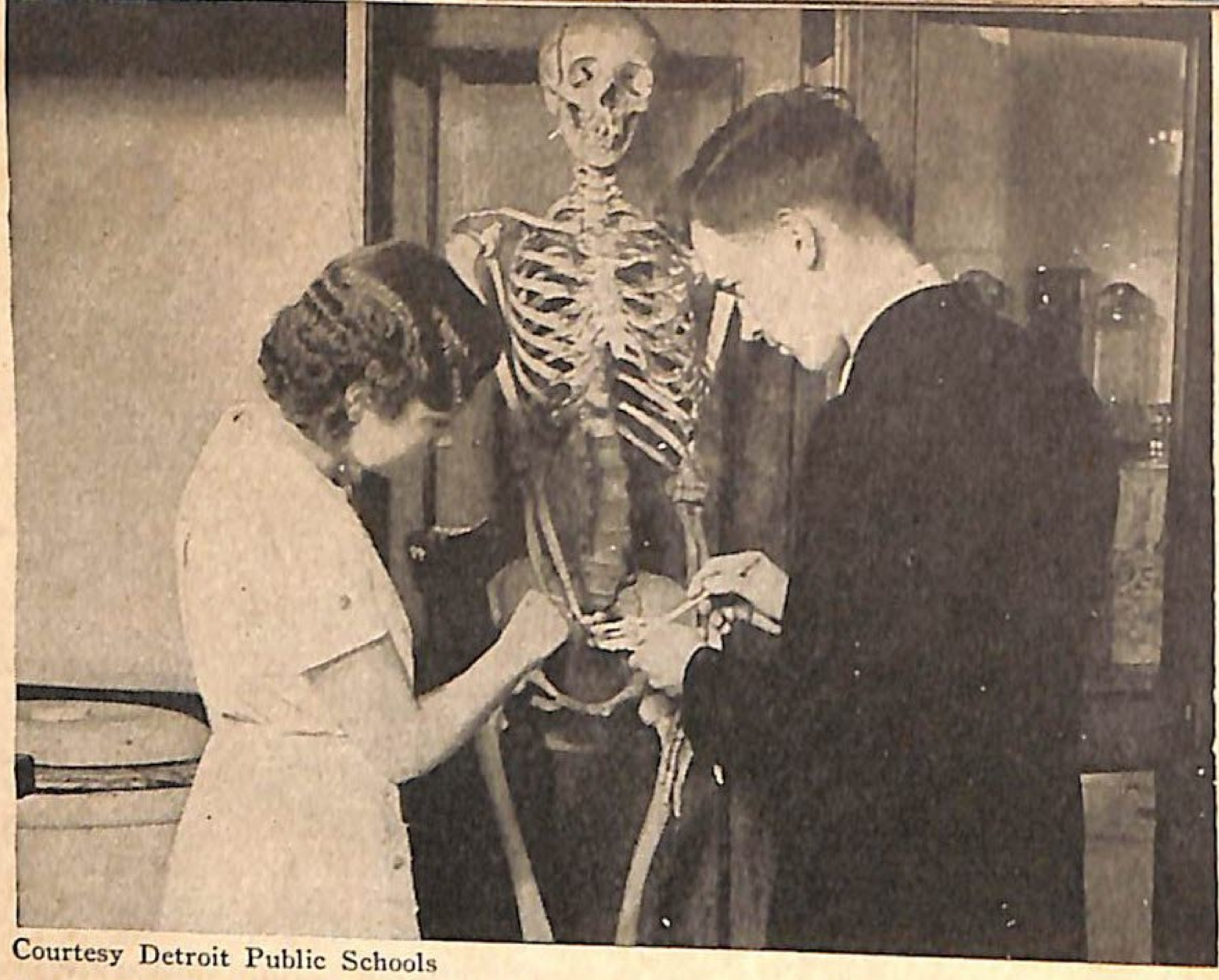
Man, an upright animal. Unlike other animals man has learned to travel on two legs instead of four. In this position man is able to carry on many more activities than if he walked on all fours. A baby learning to walk has difficulty balancing his weight on two legs. Yet, when he has fully acquired this ability, he develops a pleasing carriage. Unfortunately, as he grows older, he does not always keep this posture.

Body alignment. The human body is made up of the head; the trunk, with its flexible backbone; the legs and feet; the arms and hands. The muscles that hold the head, trunk, legs and feet in a straight line, or in alignment, are arranged in sets on the front and the back of the body. When a set of muscles on one side of the body contracts, a set on the opposite side relaxes. The equalized contraction of all the muscles holds the body erect. Whenever any set of posture muscles relaxes, the body slumps at that point, and the slump is increased by the pull of gravity. The more the body slumps, the greater is the energy expended to support its weight. This increases the extent to which a person tires while standing for a long time.



A LATERAL VIEW of an adult vertebral column shows the curves and the divisions of the column with reference to the spaces from which the spinal nerves emerge.

The backbone or spinal column consists of segments (vertebrae) that are separated by pads of gristle (cartilage). Viewed from the side, the spinal column takes the shape of a long, slender letter S, the upper end pointing forward. This curvature of the backbone eases the jolts that come from walking and other body



Courtesy Detroit Public Schools

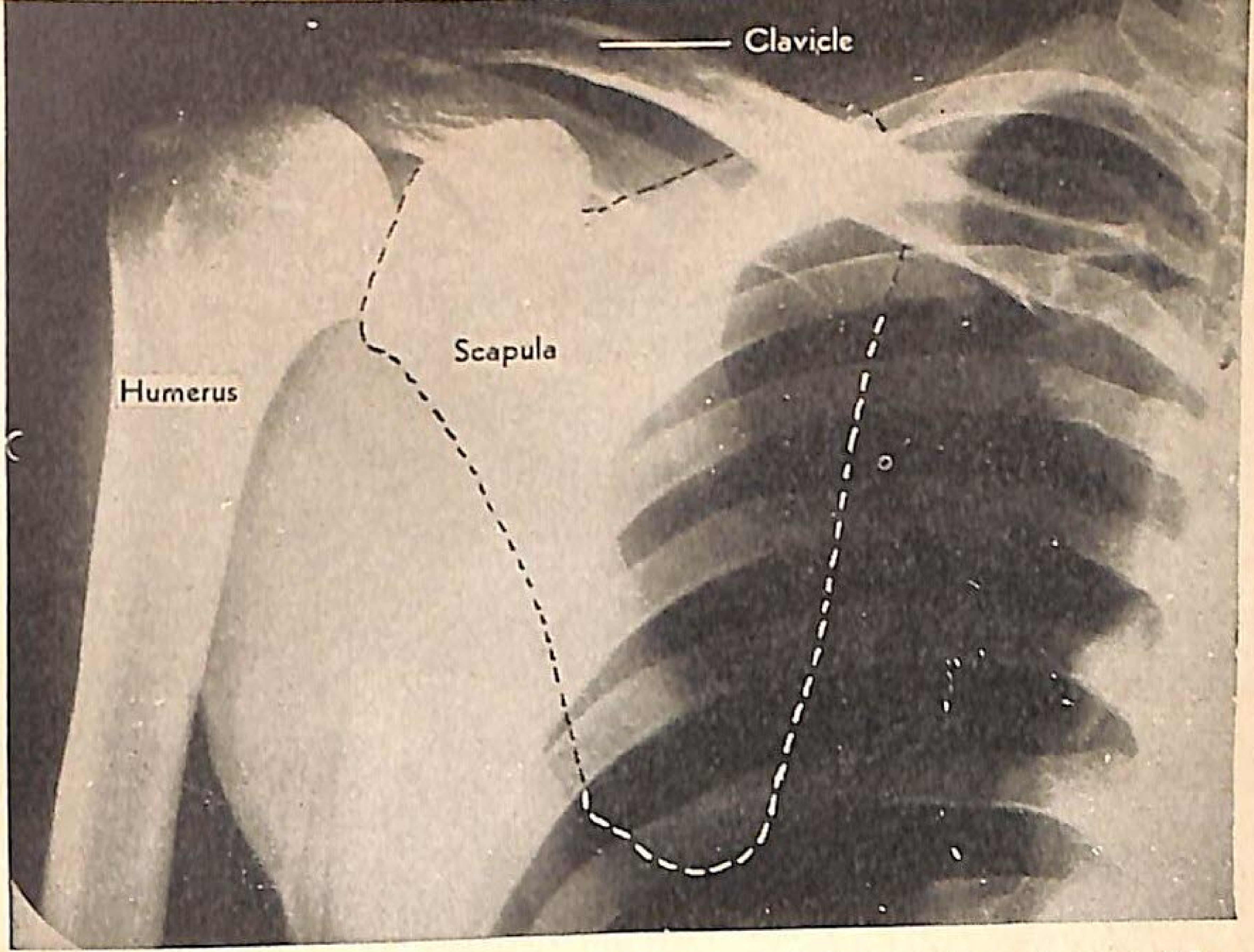
THIS BOY AND GIRL are learning the importance of good framework for the body by examining the shape and arrangement of the bones of the skeleton.

movements. If the muscles become weak, the curves may become exaggerated.

The change from good to bad posture usually starts in the neck and upper back. At first, the head drops forward, the chest flattens, and the shoulders become rounded or humped. Later, the lower back begins to hollow excessively, the abdomen protrudes, and the hips bulge out behind, making a figure similar to that shown in the diagrams on page 14.

Body framework. The muscles which hold the body erect are attached to the bones of the skeleton. Besides serving as a framework and a support for the muscles, the bones protect certain organs. The skull protects the brain, and the bones of the chest protect the lungs and the heart. The muscles and the bones together form the means by which parts of the body move one on another and by which the body as a whole moves over the ground as in walking and swimming.

In the body of an adult there are 206 bones of many different shapes and sizes. The places where the bones are joined are called *joints*. You are familiar with the enlarged and rounded

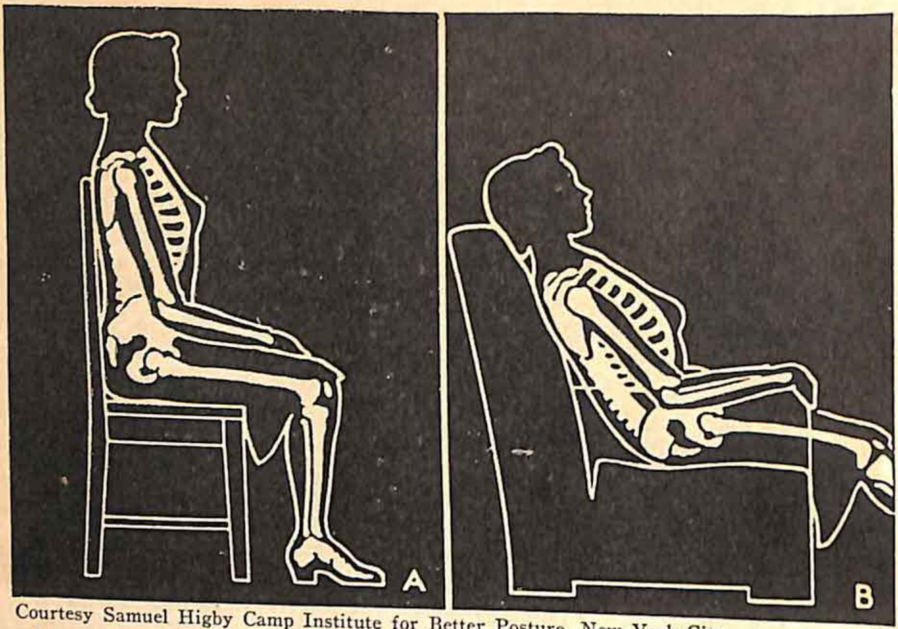


AN X-RAY PICTURE of the right shoulder, with arm hanging at side, shows the collar bone (clavicle), humerus, and shoulder blade (scapula) by dotted outline.

ends of the leg bones of a chicken. These ends are covered with a smooth membrane, *synovial membrane*. This secretes a fluid that lubricates the joint. As a result, bones slide over one another smoothly and noiselessly. If this membrane and fluid are injured by accident or disease, stiff and painful joints may result.

Bones and joints. The bones are held firmly together at the joints with strong bands called *ligaments*. Some of the joints are immovable—those between the bones of the skull; others are only slightly movable—those between the vertebrae; still other joints are very freely movable—those at the elbow and shoulder. A few people are said to be "double-jointed," because their bones are loosely connected at the joints, and the action of the joint appears to work in two directions instead of one.

Bones are alive. They grow rapidly during early childhood, some of them not maturing until the early twenties. They change their relative composition with advancing age. The bones of children contain a larger proportion of cartilage, a substance softer than bone and often referred to as *gristle*. The bones of older people are more "brittle." They have less cartilage and a



Courtesy Samuel Higby Camp Institute for Better Posture, New York City

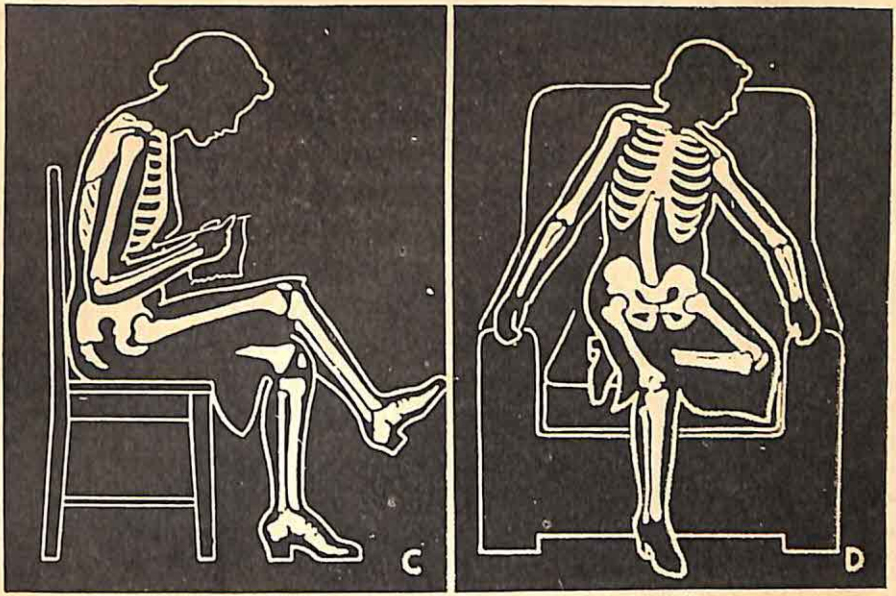
IN *A*, a good sitting position, the body is relaxed; the entire back of the body is supported against the back of the chair; and the feet are flat on the floor. In *B* the body is slumped on the end of the spine, causing the lower back to sag down.

larger proportion of lime salts, chiefly calcium carbonate and calcium phosphate. These salts are extracted from the blood by the living bone cells.

Health and posture. If the body is allowed to slump, the lungs are compressed so that the oxygen intake is limited, and the intestines and stomach are crowded so that proper digestion of food and elimination of waste may be interfered with.

Some conscious effort is necessary to maintain posture so that the muscles may be kept in good tension or tone (see p. 259). Games and all-round physical activities tend to strengthen the muscle groups and the internal organs. Special exercises can be prescribed by the family physician for remedying special weaknesses. Physical defects should be corrected as far as possible, and the importance of adequate food and rest must not be forgotten.

As others see us. To see ourselves as others see us might be a disturbing experience. One way to improve personal appearance is to recognize postural defects and then try to correct them. For



Courtesy Samuel Higby Camp Institute for Better Posture, New York City

IN *C*, the back is being curved badly. When leaning forward in sitting, the body should bend from the hips; the whole length of the thighs should be supported; and the base of the spine should rest against the back of the chair. Twisting the body habitually, as shown in *D*, should be avoided, as this interferes with good body balance.

example, one of your defects may arise from the common habit of standing on one foot or of sitting in a slumped position.

One can study posture while standing in a relaxed position before a full-length mirror. The head should be balanced easily, with the chin back and the chest up. The shoulder blades should not project backward, and the lower abdomen should be held in and flat. The knees should neither be bent nor thrust back, and the feet should be parallel and two to three inches apart. A simple test can be made by backing up against the wall so that heels, hips, shoulders, and head touch the wall. The curve in the small of the back should be so slight that the flat hand cannot be passed between the back and the wall. These standards have been accepted by authorities in physical education. A good way to acquire correct posture is to imagine that you are supporting a weight on your head and to stand and walk in such a manner that the imaginary weight would not drop.

Courtesy Harold M. Lambert

BODY BALANCE is important in roller skating and bicycling.

Since nearly everyone spends a great deal of time sitting, the sitting position is as important as the standing position. In sitting, the hips should be far enough back on the seat to allow the thighs to support the weight of the body. The chair seat should be narrow enough to permit this, and low enough to allow the feet to rest flat on the floor. In leaning forward to read or write, the body should bend at the hips. Slumping forward tends to develop round shoulders and backward curvature of the spine.

When lying down, all voluntary muscles should be relaxed. Conscious relaxation of the muscles is an aid to sleep.

To develop good habits of posture, we must practice standing and sitting as we wish to stand or sit when our minds are concentrated on something else.

In conclusion

IN AN upright body the internal organs are so suspended as to favor their normal functions. The habits of the individual in sitting, lying, standing, and walking greatly influence bodily activity. A poor posture may become fixed during the years of growth as the developing bones accommodate themselves to the deformity. Not only is personal attractiveness related to the carriage of the body, but mental energy and alertness are expressed by the way one sits, stands, or walks.

Activities

1. Determine the proper height of a chair. With the feet flat on the floor, and with knee bent, measure the length of the leg from the floor to the undersurface of the thigh at the knee. How many inches? Measure the height of the front of the seat from the floor. How many inches? This measurement should be one inch less than the leg measurement. If the seat is not adjustable, how can you make the correct adjustment?

2. Determine the effect of rest on the height of the body. Before going to bed, measure your height by standing against a wall upon which a piece of paper has been fastened. Mark your height on the paper or, better, have someone else do it for you. When you get up the next morning, have a second mark made of your height. Is the mark lower or higher? How much, if any, did you gain or lose overnight? Explain.

3. Study the chemical composition of bone.

a. Leave a wing or leg bone of a chicken in dilute hydrochloric acid for several days. What has happened to the shape and stiffness of the bone? Can the bone be tied in a knot? Which part of the bone has been dissolved out by the acid?

b. Weigh the cleaned leg bone of a chicken. Burn it on a wire gauze in the science laboratory. Let it cool and weigh it. How has the bone changed? What part of the bone burned away?

4. Study examples of good posture. In illustrations in this book or in pictures that you may collect, point out good use of the body in sitting, standing, walking, and playing.

Test

Directions: There are five incomplete statements in this test (A, B, C, D, and E), each followed by a varying number of parts. One or more of these parts, or perhaps none of them, correctly completes the incomplete statement. On your paper copy the five letters and the numbers of their parts in a vertical column. Place a plus sign (+) after the number of each part that correctly completes the statement. Do not write in the book.

A. The backbone holds the body erect because it is
    1. made up of separate parts.
    2. shaped like a long letter S.
    3. supported by two opposing sets of muscles.
B. Poor posture
    1. increases fatigue.
    2. makes one appear less conspicuous.
    3. detracts from personal appearance.
    4. may interfere with the normal action of the internal organs.
    5. becomes fixed as the body grows.
C. Good posture habits may be developed by
    1. imitating the friends you like.
    2. recognizing postural defects and trying to correct them.
    3. studying posture charts.
D. You can obtain good body posture by
    1. observing your physical education teacher.
    2. observing yourself in a full-length mirror.
    3. sitting, standing, and walking correctly.
    4. persistent, well-planned exercise.
    5. adequate food, sufficient rest, and fresh air.
E. Posture is related to health because it
    1. is admired by everyone.
    2. makes one's clothes fit better.
    3. aids the body in developing symmetrically.
    4. makes full expansion of the lungs possible.
    5. improves muscle tone.

Associated subjects

Art: The relationship between the muscles and the joints in the drawing of the human figure.

Biology: The freedom man has gained by being able to balance and walk on two feet. . . . The adaptation of the arrangement of the bones and muscles of the body to man's needs.

Chemistry: The chemical composition of bone. . . . An understanding of elements and compounds.

Dramatics: The importance of poise and good carriage for public entertainers.

Home economics: The importance of posture in relation to the fitting and wearing of clothing.

Physical education: The tests for posture and the special exercises to correct poor carriage. . . . The need for regular exercise to strengthen and keep the trunk muscles in condition.

Physics: The mechanical principles upon which the bones and muscles of the body operate. . . . The effect of gravity and the relationship between curves, jars, and strain.

References

LANE. *Your Carriage, Madam!*
RATHBONE, BACON, and KEENE. *Health in Your Daily Living.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Films

Body Framework. 15 minutes, silent. Eastman.
Improving Your Posture. 10 minutes, sound. Coronet.

3. *YOUR FEET ARE YOUR BODY'S FOUNDATION*

YOUR feet are the foundation upon which your body is supported. No part of the body is more closely related to your comfort and the proper enjoyment of work and play. You appreciate this each time you wear a pair of ill-fitting shoes. You realize then that if your feet hurt, you hurt all over: your back and legs ache and you tire more easily.

Next to tooth decay, defects of the feet are the most common physical defects found among high school pupils. In an examination of high school pupils, 60 percent of the girls and 57 percent of the boys showed unsatisfactory foot conditions. These percentages will unfortunately tend to increase with increasing age. Few persons reach adulthood without some type of foot trouble.

Do you know . . .

1. How the foot is adapted to hold the weight of the body?
2. How the feet should be used in walking?
3. How one can recognize flatfoot?
4. Why strengthening the muscles of the leg help the feet?
5. What causes feet to swell?
6. How one can overcome excessive sweating of the feet?
7. Why shoes that are too small harm the feet?
8. Why extremely high or extremely low heels are injurious?
9. How shoes should be selected?
10. If high heels can be worn safely at any time?
11. What kind of heels should be worn at school?
12. How arch supports may be harmful?
13. That defective feet are found frequently among young people?
14. That foot strain may result from poorly developed muscles?
15. That there are exercises which will strengthen weak feet?
16. How to prevent an ingrown toenail?
17. How the bones of the feet are held together?
18. How the feet protect the body against jolts?
19. Why rubber footwear should not be worn indoors?
20. What is the best material for the making of shoes?

Courtesy Denver Public Schools

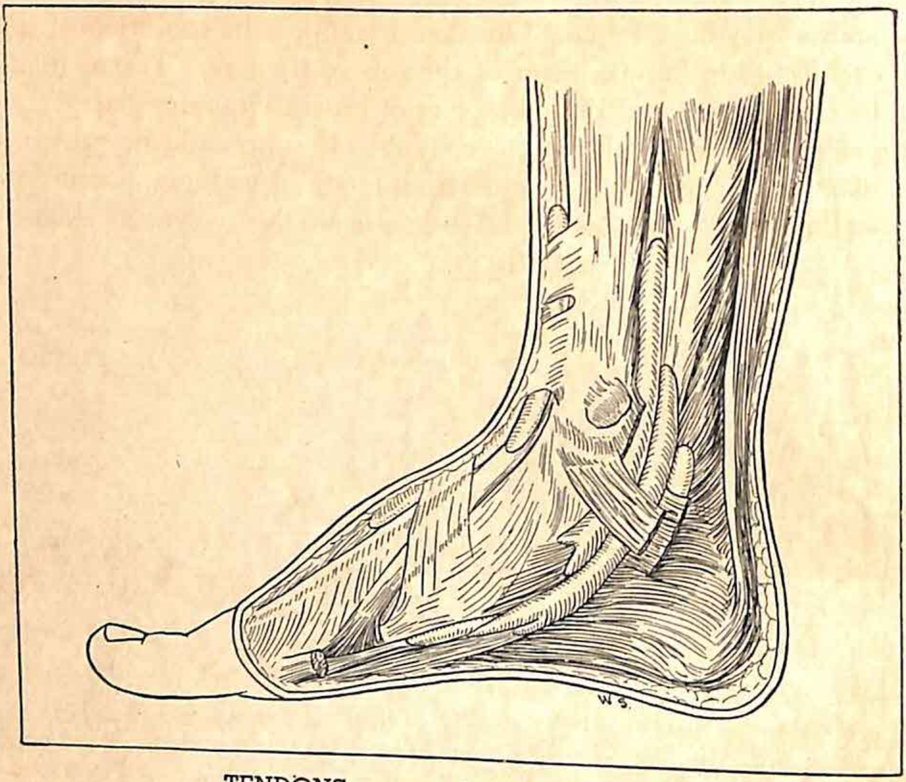
"BOY, are my feet tired!" This boy's feet no doubt feel as large as they look in this picture.

Bearing the weight of the body. The framework of the foot consists of small bones which are held together by bands called *ligaments*. Muscles which are fastened to the bones by *tendons* control their movement. In the normal human foot the bones are so arranged as to form two arches. The long arch extends from the heel to the ball of the foot. The short arch runs across the ball of the foot, at right angles to the long arch. These long and short arches are held up by means of the ligaments and by the muscles of the leg and the foot.

The arches of the foot resemble the arch of a bridge in that they possess strength and ability to distribute the load they carry. The slight curvature gives elasticity to the action of the foot. At each step, the arches give slightly and then spring back again. This movement makes it possible to walk and stand for a long time without fatigue or injury to the foot. The arches also save the body from jolts received in walking. The normal action of the arches is often interfered with if there is a bending-in of the ankles and knees. This may cause arch strain.

Feet that are well built support the weight of the body without injury. In such activities as jumping, the feet must be capable of withstanding a force equivalent to several times the weight of the body. To withstand this additional strain, the muscles have to be strengthened through proper exercises.

The foot in action. It has generally been taught that for correct action the foot should be placed on the ground parallel to the line of movement and that the toes should not be turned outward or inward but should point forward. In walking, the heel and ball should strike the ground as nearly simultaneously as possible, and the weight should be carried forward to the ball of the foot



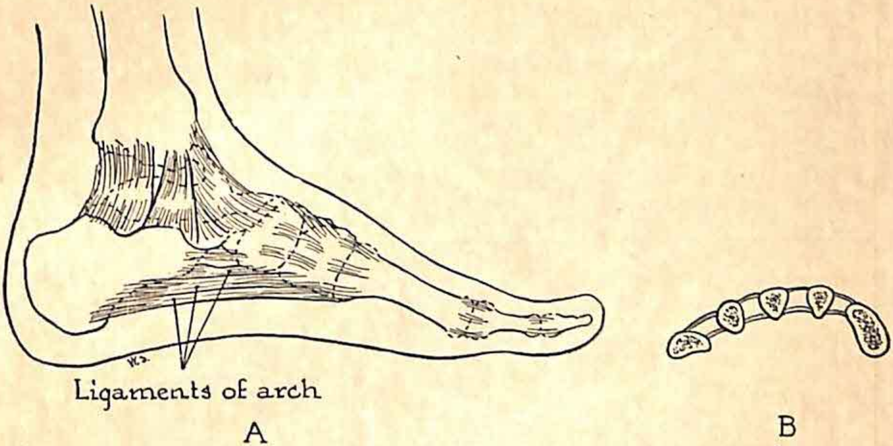
TENDONS support the arch of the foot.

along the outer part of the foot. At every step, the body should rise on the ball of the foot giving the effect of buoyancy. Dragging the feet or pounding the heels should be avoided. Some anatomists regard a mild degree of out-toeing as the position of greatest efficiency for a well-constructed foot whether standing or walking. In the main, the correct action of the feet goes with good posture.

Foot defects. Weak foot and leg muscles throw a strain on the supporting structure of the arch. The attached ligaments and tendons may become weakened. This condition is often referred to as *flatfoot*. It might better be called "weak feet"; or we might say that the person is suffering from "foot strain."

In the beginning, defective feet do not always cause pain. Weak feet show a tendency to "toe out" and to roll inward at the ankle. The ankles may swell because of poor circulation. The arches may have fallen. One can determine the condition of the arch by examining a print of the sole of the foot. This is made by placing the wet foot on a piece of brown wrapping paper.

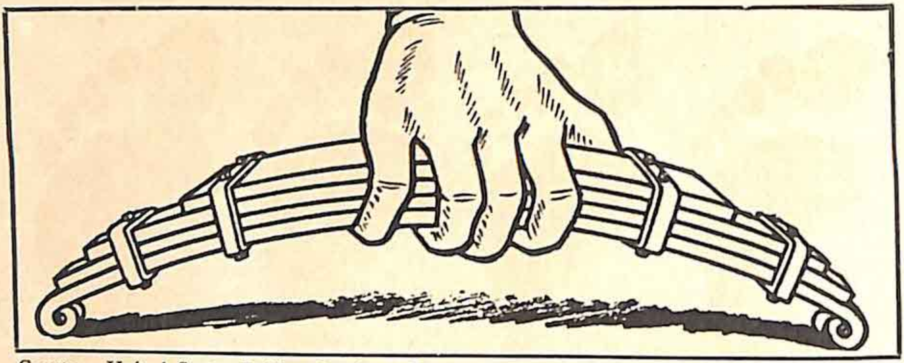
Standing and walking correctly are also important in reducing foot strain. Standing is more tiresome than walking, because in walking some muscles work while others relax, whereas in standing the muscles remain more or less steadily contracted. When standing, also, the circulation of the blood is less active, especially in the legs. Correct posture aids the flow of the blood. Exercises help to strengthen muscles that have become weakened. If, after exercises have been carried out, the feet continue to give pain, a physician should be consulted.



THE LONGITUDINAL ARCH of the foot and the ligaments which help to support it are shown in *A*. The transverse arch (*B*) extends from the ball of the foot to a point back of the little toe. The foot is really a tripod standing on the three points: the heel in back and two supporting points in the ball of the foot.

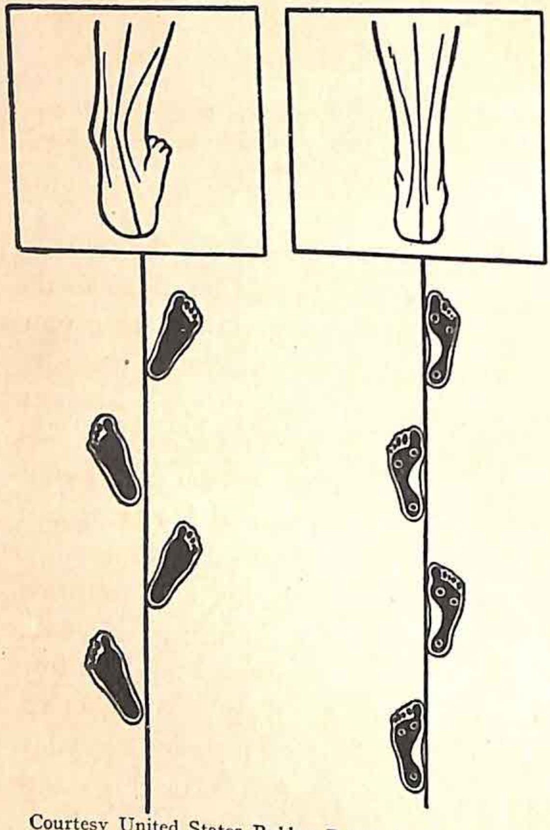
Daily care of the feet. The feet should be bathed each night before retiring. They should then be carefully dried, especially between the toes to lessen the chances of infection. Clean stockings should be put on each morning. If the feet perspire freely, the frequent changing of both stockings and shoes is advisable. Each time the shoes are taken off, they should be thoroughly aired before they are put on again.

Excessive perspiration of the feet can be reduced by foot baths,



Courtesy United States Rubber Products, Inc.

THE MAIN ARCH of the foot is comparable to a spring which, if strong, will resume its arched position after pressure is released.

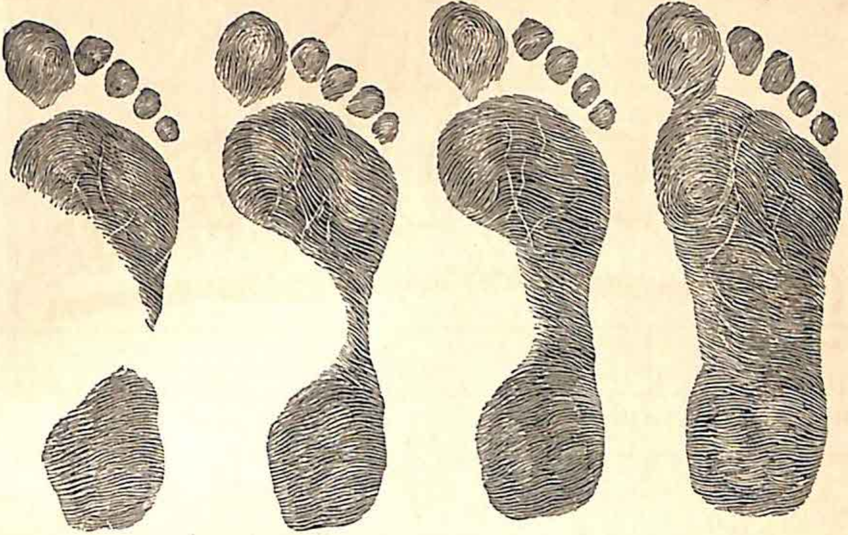


Courtesy United States Rubber Products, Inc.

IT IS INCORRECT to walk with the toes turned out (*left*). In correct walking (*right*), the toes are pointed straight ahead.

and by a proper alternation of rest and foot exercises. Fatigue often increases perspiration. To stimulate circulation and counteract perspiration, the feet should be washed daily with salt water or soap and very warm water, rinsed with cold water, and dried with a coarse towel. Alcohol rubs and bathing in a very weak solution of formalin also help to "harden" the feet.

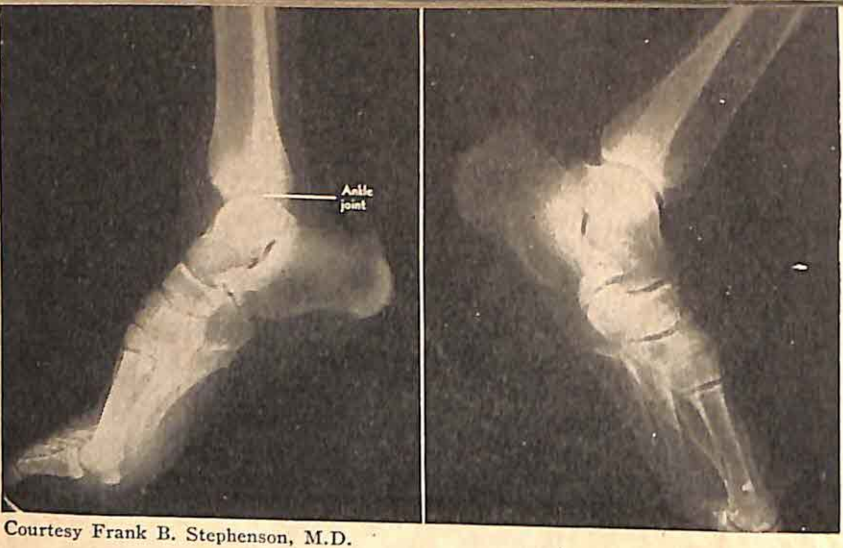
Toenails should be cut straight across and shorter than the flesh, so that the shoe will not press against them. This will help greatly in preventing ingrown toenails.



BY TAKING PRINTS of the foot, one may determine what sort of an arch he has. *From left to right*: a high arch, a moderate arch, a low arch, and a flat foot.

Size and style of shoes. Since improper shoes are the cause of most foot troubles, careful consideration should be given to the selection of shoes. The shoe should be long enough to extend beyond the large toe and wide enough not to cramp the toes. The wearing of shoes that are too short may produce *bunions*. If pointed shoes are selected, they should extend beyond the toes before they start to narrow down. The inner border of the shoe should be nearly a straight line. The soles should not be so stiff as to prevent movement of the joints of the foot in walking.

The heels of shoes should not be too high, as this tends to throw the weight of the body on the ball of the foot, injuring the small, or short, cross arch. But sudden change from very high to low heels may also disturb the balance of the body. High-heeled shoes are generally too short for the wearer. Heels for everyday use should not be more than one and one-fourth inches high and should be as broad on the wearing surface as the wearer's heel. Heels should be placed so that the weight of the body is not thrown forward onto the front of the foot. Rubber heels reduce the jars from hard floors and pavements.



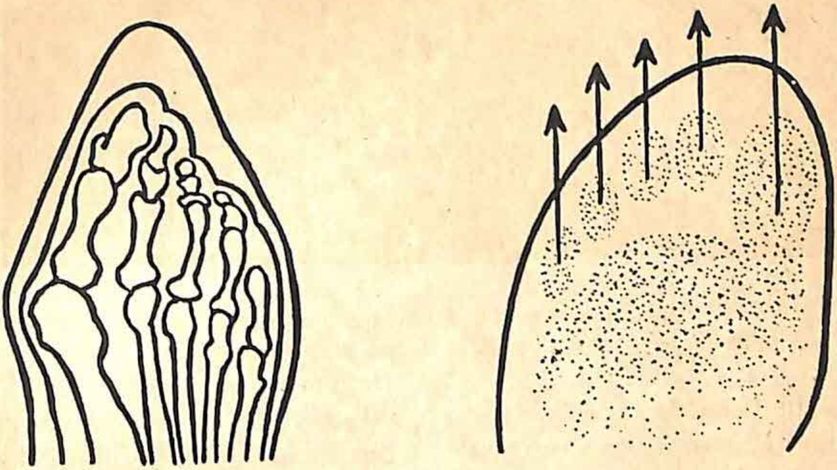
Courtesy Frank B. Stephenson, M.D.

X-RAY PICTURES taken of the ankle and foot of individuals standing on tiptoe show a normal arch (*left*) and a flat arch (*right*).

The heels on the shoes of boys and men are usually more sensible than those of women and girls because social custom does not demand high heels in men's footwear. Girls sometimes wear high heels because they think that this makes their feet look smaller. Any gain in that direction is more than balanced by the uncertain, tottering gait resulting from the high heels. Few girls' feet are so large that they need to be made to look smaller. High heels, except perhaps for dancing, are not appropriate where the feet are to be active.

Arch supports or ankle braces should be worn only on the advice of a physician. They tend to weaken muscles that should be strengthened, if possible, by use.

Kind of material for shoes. Natural leather does not shrink and expand with changes in the weather, and perspiration can, to some extent, evaporate through the pores of the leather. Shoes made of artificial leather, especially patent leather, are often very uncomfortable, since they allow less moisture to evaporate from the feet. Excessive perspiration of the feet may often be caused by shoes made of imitation leather. Rubber or composition soles, such as are found on tennis and other sport shoes, have the same effect on the soles of the feet as imitation leather. Rubbers and galoshes should not be kept on while indoors, partly because they allow less moisture to evaporate from the feet, partly because they make the feet excessively hot and render the wearer more susceptible to later chilling. They should, however, be worn out-of-doors according to the requirements of the weather.



DISCOMFORT

COMFORT

Courtesy United States Rubber Products, Inc.

FOR FOOT and body comfort, the toes should work freely in a straight line.

In conclusion

THE feet should support the weight of the body without injury or undue fatigue in standing and walking. Foot strain develops if the feet are restricted in their action and if the muscles that control the movements of the feet become weakened through disuse, illness, or carelessness in habits of walking and standing.

Activities

1. Are you wearing correct shoes? Stand on a sheet of paper and make an outline drawing of the sole of your shoe. Next stand with your bare foot on this outline and trace around the foot. In what ways are the two outlines alike or different?

2. Study a diagram of the skeleton of the human foot in order to locate the arches in your foot. Make an impression of your foot by wetting it and placing it on a piece of brown wrapping paper, as described in the chapter, and decide if your arches are in good condition.

3. List bodily symptoms which might be attributed to weak feet. Watch people on the street for facial signs of aching feet and for bodily attitudes associated with them.

Test

Directions: From the following list, select *eight* characteristics that should be given special consideration in the selection of shoes. On a separate piece of paper arrange these in order of importance, followed by a brief statement of your reason for the selection. Do not write in the book.

1. cost
2. length
3. width
4. shape of toe
5. inner border
6. high heel
7. low heel
8. medium heel
9. position of heel on shoe
10. stiff sole
11. flexible sole
12. rubber sole
13. patent leather
14. cloth
15. natural leather
16. color
17. conformity to fashion
18. artificial arch support

Associated subjects

Biology: The development of bones and their arrangement in relation to deformities of the skeleton.

Home economics: The selection of correct footwear for particular occasions.

Physical education: The examination of feet for foot strain. . . . Special exercises to correct and strengthen foot action.

Physics: The three kinds of levers and their relation to foot action and to the angles of the ankles and knees.

References

LANE. *Your Carriage, Madam!*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*

Film

Our Feet. 11 minutes, sound. Bray Studios.

3. List bodily symptoms which might be attributed to weak feet. Watch people on the street for facial signs of aching feet and for bodily attitudes associated with them.

Test

Directions: From the following list, select *eight* characteristics that should be given special consideration in the selection of shoes. On a separate piece of paper arrange these in order of importance, followed by a brief statement of your reason for the selection. Do not write in the book.

1. cost
2. length
3. width
4. shape of toe
5. inner border
6. high heel
7. low heel
8. medium heel
9. position of heel on shoe
10. stiff sole
11. flexible sole
12. rubber sole
13. patent leather
14. cloth
15. natural leather
16. color
17. conformity to fashion
18. artificial arch support

Associated subjects

Biology: The development of bones and their arrangement in relation to deformities of the skeleton.

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References

Lane. *Your Carriage, Madam!*
Wheat and Fitzpatrick. *Health and Body Building.*
Williams. *Healthful Living.*

Film

Our Feet. 11 minutes, sound. Bray Studios.

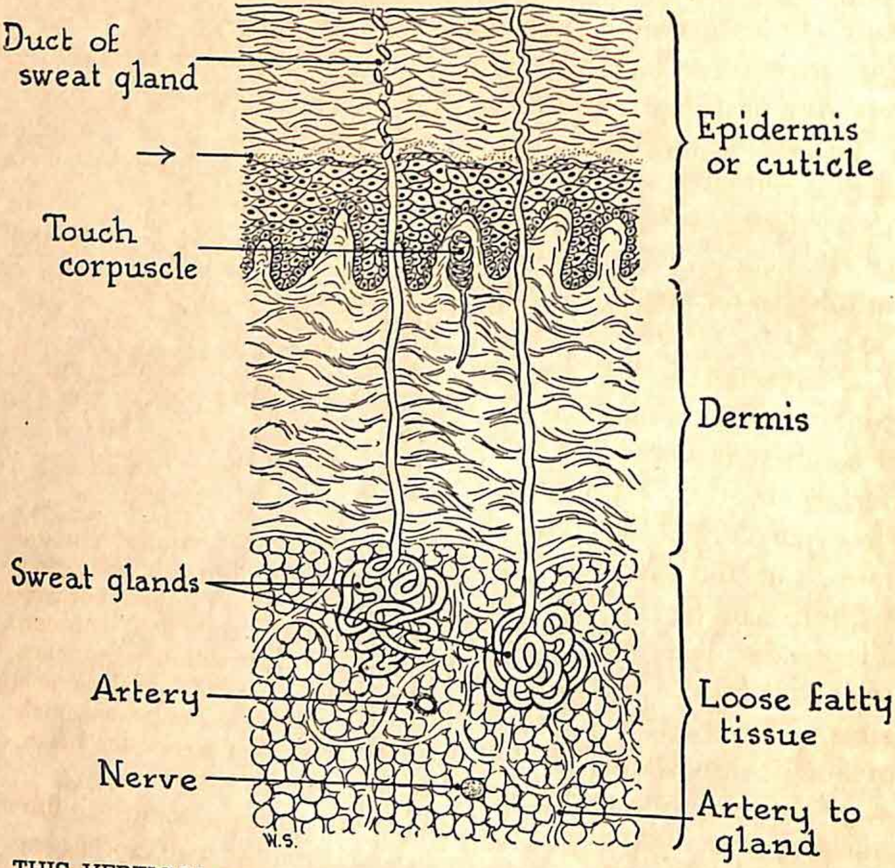
4. THE SKIN IS NATURE'S COVERING FOR THE BODY

NATURE has provided your body with a remarkable covering. If you go to sleep and the room grows too cold or too warm, it is your skin that first detects the change. If the air in summer becomes hot and dry, it is your skin that prevents your body from drying up. If you go swimming, it is your skin that keeps your body from becoming water-soaked. It helps keep out harmful bacteria and poisons. It regulates the temperature of your body. At all times your skin is subject to much wear and tear, but under normal conditions it is able to replace itself when scraped or worn away.

Do you know . . .

1. *How body heat is produced?*
2. *What causes sweat?*
3. *How the body loses heat?*
4. *Why the skin is an indicator of health?*
5. *What is the cause of a poor complexion?*
6. *What causes differences in skin coloring?*
7. *Why sunlight is beneficial to the skin?*
8. *Why underclothing should be changed frequently?*
9. *How often a bath should be taken?*
10. *What is the best way to bathe?*
11. *Why a cold shower after a warm bath is beneficial?*
12. *Why cold baths may sometimes be harmful?*
13. *In what ways cosmetics may be injurious to the skin?*
14. *Whether the use of cold cream is a satisfactory method of cleansing the pores?*
15. *When the use of deodorants may be necessary?*
16. *How excessive eating of sweets may affect the skin?*
17. *What are the causes of corns, calluses, freckles, and boils?*
18. *Why young people often have blackheads, pimples, and acne?*
19. *What skin diseases are contagious?*
20. *What may be the cause of hives?*
21. *What precautions must be taken to prevent the spread of athlete's foot?*
22. *How sunburn can be prevented?*

The skin itself. Two layers of cells—the *epidermis,* or outer layer, and the *dermis,* or inner layer—make up the skin. These layers of cells constitute about six pounds of the weight of the adult body. The inside cells of the epidermis are round and soft.

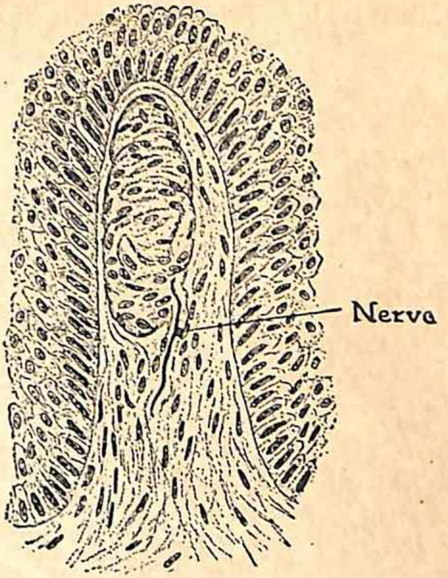


THIS VERTICAL section shows the skin and underlying tissues greatly magnified. The arrow near the top at the left indicates where the epidermis separates in the formation of a blister.

The outside cells are flat, hard, and horny. On the fingers and toes, a modification of the horny layer forms the nails. The dermis consists mainly of interlacing cells of connective tissue that give the skin its toughness.

On the finger tips and in the palms of the hand parallel ridges can be seen. These form a pattern of fine lines and are due to rows of tiny swellings (papillae) in the true skin or dermis. In these papillae are found ends of nerves and loops of small blood vessels, tiny tubes which carry the blood supply to and from the skin. The size of these tubes is controlled by the nerves which respond to changes in temperature. Other nerves in the papillae detect the shape and temperature of things touched.

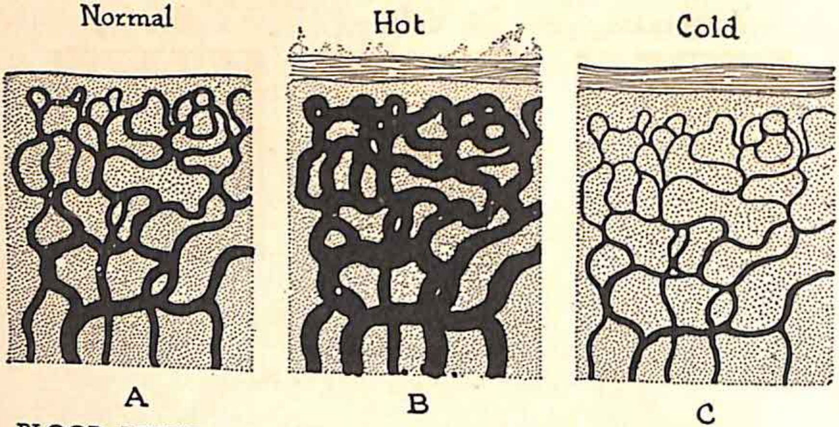
Glands of the skin. Sweat glands and oil glands are buried in the dermis or true skin. The sweat glands, which vary in number in different areas of the body surface, open to the outside through pores. Water, containing salt and other solids in solution, is poured out on the surface of the body through these pores. The water evaporates, but the salt and other solids remain on the skin. The oil glands open into the pits (follicles) from which the hairs grow. They secrete an oil which makes the skin flexible and soft, keeps the skin from drying and cracking open, and prevents water from penetrating the skin. The same sort of natural hair oil softens the hair on the scalp and keeps it from becoming brittle.



THIS SHOWS a papilla beneath the epidermis. The oval body, consisting of cells arranged horizontally, is a touch corpuscle. Among these cells terminate the branches of a nerve. Pressure on the touch corpuscle starts an impulse which travels over the nerve to the brain.

Man, a warm-blooded animal. Imagine living as the snakes, frogs, and other cold-blooded animals do. During cold weather, life processes would become so sluggish that one would have to hibernate. During hot weather, one would have to move into the ground or the deep water to keep cool. Only in the evening could one come out with "pep" enough to engage in the necessary activities of living.

Heat production. Heat is produced by the burning or oxidation of food in the body. The energy stored in food is released as the



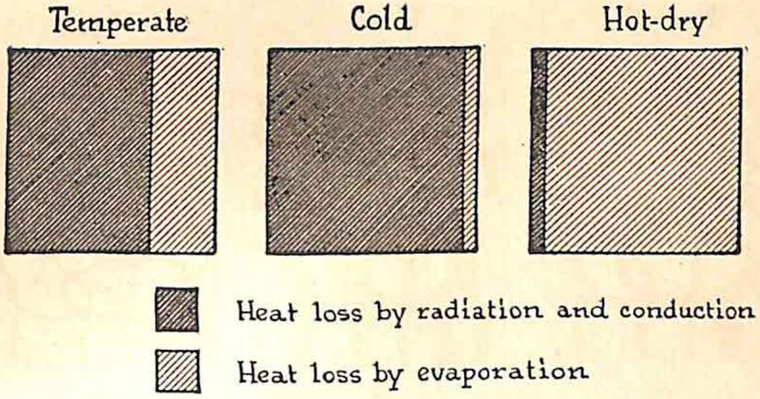
BLOOD VESSELS increase in size with the application of heat, shown in *B*, and decrease with cold applications (*C*). The effect, however, is only temporary, since they soon return to normal condition, as shown in *A*.

foodstuffs are burned. The greatest amount of heat is contributed to the body by the oxidation which takes place in the skeletal muscles.

The frog is called a cold-blooded animal because its body temperature is nearly that of its surroundings. It is able to live for months without food; whereas, a warm-blooded animal can live only a short time after its food supply is cut off. So sensitive are we to disturbances in body temperature that we are usually considered to be sick if our bodies vary as much as a degree from the normal of 98.6 degrees F.

The circulation of the blood from one organ or part to another helps to keep the temperature of the body uniform. It permits the throwing off of excess body heat through the skin. If the body is to be cooled, much blood goes to the skin. If the air is too cool, a much smaller amount of blood is supplied to the skin, so that less heat is thrown off. The body produces and loses heat continuously. In order to maintain a fairly uniform temperature, there must be a balance between heat production and heat loss.

Heat loss. Heat is lost from the skin by radiation, conduction, and evaporation. As explained in your classes in physics, radiation is not affected by air or its temperature. Conduction and evaporation, however, are greatly affected by the temperature of the



HEAT LOSS is greatest by evaporation in a hot-dry climate. While in a cold climate more heat is lost by radiation and conduction.

surrounding air. Much heat is lost in warming the layers of air which are in contact with the body. Heat is also lost by conduction when the body comes in contact with cooler solid objects. The heat conducted from the body varies with the substance in contact with the body: iron and water conduct heat away quickly; air and glass are slow conductors.

If the temperature of the surrounding air is above that of the body, and if heat cannot be lost by conduction, the sweat glands provide a means for cooling the body; for heat is used in the evaporation of the sweat or perspiration from the surface of the body. During vigorous exercise you perspire freely and thus rid yourself of much of the surplus of heat created by the additional muscular activity.

Other warm-blooded animals regulate heat in various ways. The dog has no sweat glands, and pants when overheated. The rapid and shallow breathing rids his body of surplus heat by increasing evaporation from the mouth, the throat, and the extended tongue. In winter many animals grow a heavy coat of fur that limits loss of heat by conduction and radiation. Man accomplishes the same result by putting on more clothing as the temperature outside of the body diminishes.

Skin color. Tiny grains of brown or reddish yellow coloring matter or pigment are buried in the inner layer of the epidermis.

Courtesy Maine Development Commission

ACTIVE EXERCISE in the out-of-doors helps give tone to the skin. Water sports are a favorite summer pastime, but participation in some form of healthful exercise should continue throughout the year.

There is a small amount of pigment in the skin of a blond; a larger amount in that of a brunet. Light and dark races of people differ in the same way. Primarily, the amount of pigment in the skin is determined by inheritance, though in a given individual the pigment may vary greatly with exposure to light.

Rosiness of the cheeks and skin depends upon the number and arrangement of blood vessels, the thinness of the outer layer of the skin, and the quality of the blood. A thin outer layer permits the color of the tiny blood vessels to be seen. Sometimes chronic pallor is due to anemia or ill health, but it is often merely a family trait. The real color of the blood may be seen in the lips and the lining of the eyelids where the outer layer of the skin is very thin.

Beauty more than skin deep. The saying "beauty is only skin deep" is misleading. Faulty habits of eating and living often destroy the healthy appearance of the skin. Unsuitable food, by lowering body resistance, may cause pimples and boils. The red color of the blood depends partly upon diet (see chap. 12). A good complexion depends not only upon proper food but also upon sleep, rest, cleanliness, exercise in the fresh air, exposure to sunshine, and proper elimination. Whatever affects the general health of the body is likely to affect the appearance of the skin.

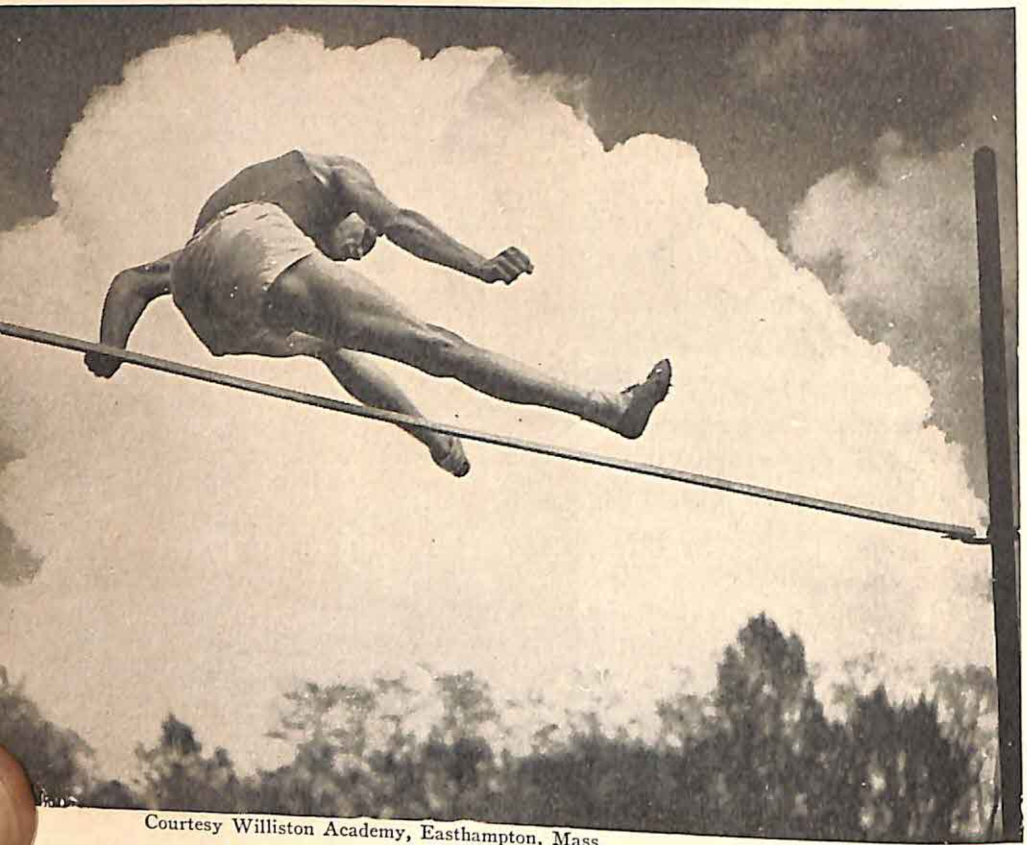
Effects of sunlight. Light consists of several kinds of rays: some give heat, some illuminate, some have an important chemical action. The redness and soreness which we call *sunburn,* as well as the coveted tan, are caused by the chemical action of sunlight. Poisons or toxic products may be formed by sunburn. It is also important to remember that the invisible rays beyond the violet of the visible spectrum (the ultraviolet rays), are especially active in toning up the skin and in giving vigor to the body (see p. 251).

Sun tan. Exposure to sunlight is usually beneficial if severe sunburn is avoided (see chap. 16). Exposing the body to gradually increasing doses will soon enable the skin to adapt itself to the sunlight. The harmful burning that may result without such care will thus be avoided.

The tan itself does not promote health. Tanning is a measure of protection against excessive sunlight. When exposed to bright sunlight, the skin reddens through the accumulation of a large amount of blood. A brownish pigment leaves the blood and is deposited in the skin when the blood recedes, thus leaving the skin tanned.

Sunburn. Some skins are especially sensitive to the sun's rays. Dusting the face and arms with a powder before going into strong sunlight may help to prevent sunburn. Grease paint is sometimes beneficial in protecting the skin from sunlight on snow or in high altitudes. Water should not be used on the skin immediately after exposure to intense sunlight.

For the treatment of sunburn, use any bland fat or oil, such as cold cream, olive oil, mineral oil, and even in an emergency, unsalted butter or lard. Such oils and fats protect the irritated nerves from exposure to the air and give comfort. Sunburn is the same



Courtesy Williston Academy, Easthampton, Mass.

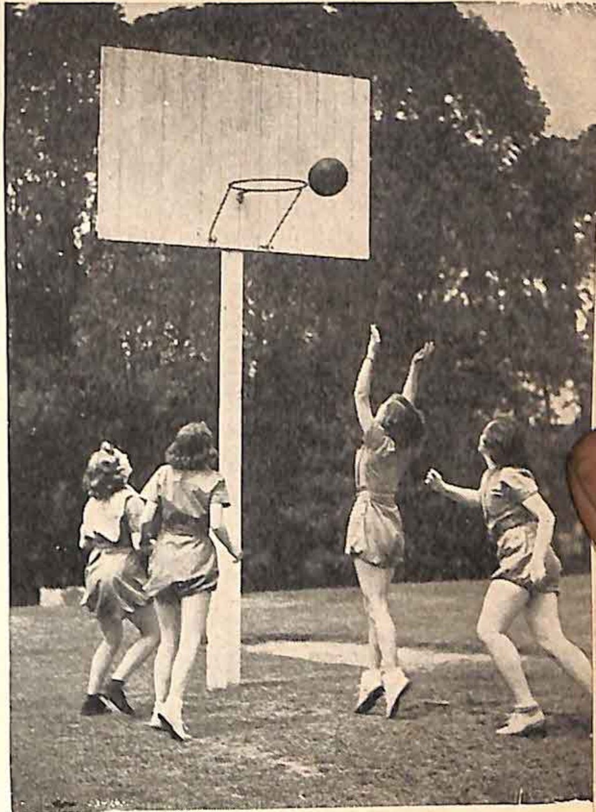
GOOD FORM in an athlete does not just "happen." It results from correct habits of living.

as any other burn and should be treated in a similar manner (see page 466). If the burn covers a considerable area or if fever develops, a physician should be consulted.

Cleanliness and personal appearance. Everyone is interested in his own personal appearance and in knowing how to improve it. Habits of cleanliness will do much to maintain a good complexion and to improve personal appearance. To be clean is not only healthful, but it makes one more agreeable to others. The plainest person, if immaculately groomed, has an advantage over the one who relies primarily on what nature has done for him.

Cleanliness and health. Ordinarily one thinks of a bath only in relation to cleaning the skin. In reality, a bath serves many other purposes. A change in the surrounding temperature affects the body. Bathing may stimulate or soothe the nerves and may tone up or relax the muscles. By stimulating the skin, a bath speeds up the circulation of the blood. Bathing of the right sort at the right time improves health.

Body odor. Some sweat or perspiration is being given off from the body at all times. Body wastes, including salts and other substances which have been held in solution, are deposited on the skin. Other substances which accumulate on the skin include bacteria, dirt, and flakes of dead skin. Bathing is necessary not only to remove these accumulations but also to avoid the unpleasant odor resulting from their decomposition. Very careful drying of the body after the bath is important. Certain regions of the body, such as the feet, the groins, and the armpits, should receive special attention. Underclothing absorbs much of the moisture given off by the body; hence, frequent change of underclothing is as important as bathing in eliminating body odor.



Courtesy Northampton (Mass.) School for Girls

OUTDOOR GAMES require energy and alertness. The best environment in which to do any type of exercise is the out-of-doors, especially when the sun is shining.

Some people perspire so excessively or the perspiration is so offensive that they feel it is necessary to use deodorants in addition to washing the body thoroughly every day and wearing immaculate undergarments and outer clothing. If deodorants are used, care must be taken in their selection, or harm may result.

Baths. A warm bath is most effective for cleaning the body. The water should be at, or a little above, the body temperature. Bathing in warm water expands the blood vessels in the skin and draws the blood away from the brain, often making one feel comfortably sleepy. Such a bath is best taken at bedtime. Some persons, however, find the warm bath stimulating and are unable to sleep immediately following it.

The hot bath, with water appreciably above the body temperature, is the proper type of bath for one who is chilled. But the warmer the bath, the more necessary is protection against chilling after the bath. Especially when a person takes a hot bath to break up a cold, it is important for him at once to get into a warm bed in a warm room. Otherwise the bath may do more harm than good.

A cold bath will at first contract the blood vessels in the skin and then drive blood to the internal organs. Being a powerful tonic to the skin, the cold bath makes one feel alert, provided the shock is not too great for one's power of reaction. A cold bath may also train the blood vessels to respond quickly to changes in temperature, so that healthy people who take cold baths regularly are generally thought to be more hardy and less subject to colds than others. The cold bath and the "rub" are to the skin what exercise is to the muscles. The body should be stimulated by the cold bath but not chilled. The cold bath should be followed by a reaction in which the surface blood vessels enlarge again so that the skin becomes warm and glowing. Brisk rubbing with a rough towel will help to secure this reaction. If no such reaction follows, the bath may have been too cold or too prolonged, or the body may not be strong enough to endure the shock. If such conditions result, cold baths should be discontinued.

No bath of any kind should be taken within an hour after eating, for during that time more blood is needed in the abdominal organs for the process of digestion, and it is unwise to disturb the circulation at such a time.

A "well-tubbed look." A warm bath with soap for cleaning the whole body thoroughly should be taken two or three times a week (once a week if a brief cold bath is taken every morning). A cold sponge or shower begun in summer can easily be carried on even in the winter by the hardy individual. A bath should follow exercise. One owes it to one's host and companions to bathe before going to a party or a dance. One should always bathe before going to a doctor for a physical examination.

The face and hands should be washed morning and evening; and, as a matter of health and self-respect, as often as they are soiled. Clean hands are one of the marks of refinement. For health's sake, the hands should be washed thoroughly before eating and also after going to the toilet. In washing the face, do not neglect to wash the back of the neck and the area behind the ears.

Judging soap. Soap is made of oils and alkali, strong soap having an especially high percentage of alkali. Excess or free alkali irritates animal tissues. Sometimes present also are fatty acids which irritate the skin. Special kinds of oil are used in soap to make it lather in hard water. Some people are sensitive to coconut oil used for this purpose, and if a particular soap causes irritation, it may be because of the individual's sensitiveness to this oil or some other substance.

Soap is necessary to help remove dirt from the skin. Any mild soap that lathers well and does not irritate the skin can be used. For toilet use, inexpensive brands of soap that are free from excess of alkali are most satisfactory. Soaps that contain an excess of alkali do not lather and they leave an insoluble deposit in the water. Highly scented or colored soaps should be avoided unless their quality is unquestionable. In toilet soaps, color and odor are often used to cover up ingredients that should not be tolerated even in laundry soap. No medicine put into a soap can give it special advantage over ordinary mild soap of good quality.

The skin should be thoroughly rinsed and freed from soap before it is dried, as soap remaining on the skin may cause irritation. All parts of the body should not only be thoroughly rinsed but should also be well dried, especially where skin surfaces are in contact, as between the toes.

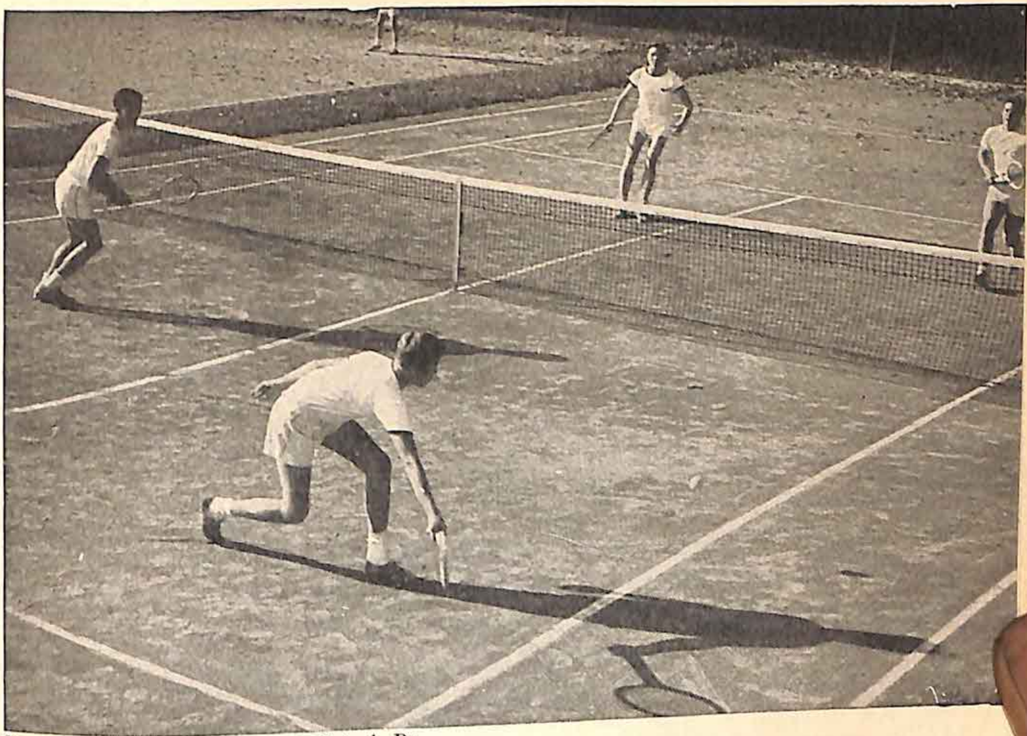
Use of cosmetics. In a discussion of cleanliness, soap, bathing, and the skin, some mention must be made of the use and abuse of cosmetics. The population of the United States has increased tremendously during the last forty years. So have the use and sale of cosmetics. But the enormous increase in cosmetic sales has not been caused only by the increase in numbers of our population. While the population has doubled within the last forty years, the trade in cosmetics has become *fifteen* times greater during the same period!

At the present time, use of cosmetics is very general. While no harm may result from the moderate use of cosmetics, no benefit to the health of the skin is derived. Girls, misguided by advertisements, often ruin a good, clear, natural skin. At best, the use of cosmetics is in large part an attempt to imitate the natural hues of a healthy complexion. It must not be forgotten also that shutting out the sun's rays with cosmetics may actually make the skin, and therefore the complexion, less healthy.

There is no substitute for healthy hair and teeth; for the clear, firm complexion that comes from proper diet, rest, exercise, and regular elimination; or for bright eyes that are not surrounded by wrinkles from lack of sleep or from some form of overindulgence. A good complexion cannot be bought in a box or bottle, no matter how beautiful the container, how enchanting the promises printed thereon, or how appealing the radio program which advertises it may be. Being pale may be natural to the individual, or it may indicate a lack of health—a condition which should be given proper treatment and not merely disguised by rouge.

The well-cared-for skin of a healthy person generally does not need cold cream to soften it or powder to remove the shine from it. Before resorting to these supposed aids to beauty, it is well to find out what careful washing will do. Often roughness and shininess are due to harsh soap, to soap left on the skin after washing, or to washing with water that is too hot or too cold. The air of overheated houses or of arid climates tends to make some skins feel too dry. In such cases, occasional use of cold cream may be advisable to keep the skin soft.

Cosmetics and charm. To the public, cosmetics are artificial aids to charm. Provided the materials are not injurious, whether or not one uses cosmetics is entirely a matter of taste. Little harm



Courtesy George School, George School, Pa.

EXERCISE keeps the blood flowing rapidly near the surface of the cheeks, brings color to the face, and gives the skin a healthful appearance.

may come to health from the use of ordinary cold creams, face powders, talcums, and rouge, provided they are thoroughly removed at night.

Yet, individuality is shown by the features of the face, and its expression may be greatly modified by excessive use of cosmetics. Moreover, heavy rouge and cream powders may injure the texture of the skin. After a study of what is suitable to the individual type of feature and coloring, cosmetics, if used at all, ought to be used sparingly. If rouge and lipstick are used, they should be carefully blended with the natural color of the skin.

Other facts about cosmetics. Some classes of cosmetics involve special risks.

Sulphide depilatories or hair removers have been known to burn the skin and to cause skin diseases.

Certain types of deodorants may cause irritation.

Hair dyes and tonics may contain such poisons as arsenic or such irritants as salicylic acid.

The hazards of eyelash and eyebrow dyes are so serious that the wise person will not risk using them.

Talcum, a cheap and relatively harmless substance found in rocks which is the basis of most face powders, is a mineral.

No cleansing cream can take the place of a mild soap, free from alkali.

Cold water is much cheaper than any astringent or tonic on the market and is as effective in contracting the pores.

No powder, lotion, or salve has so far been discovered that will permanently and safely remove hair.

Since the skin is fed from within, tissue creams have little or no value.

Freckle creams may cause soreness and disfiguration during the peeling process.

The powder puff should always be clean. One should never use another person's powder puff, because this is an easy way to acquire germ disorders of the skin, such as acne.

To use another person's lipstick may even be the means of acquiring infections, such as fever sores and trench mouth.

Lastly, products that make unusual claims and whose ingredients are not plainly marked on their labels should be avoided.

Skin disorders. Skin disorders range from facial blemishes, that are serious only as they detract from one's personal appearance, to conditions that menace the health of the individual and of those around him. In the following discussion the disorders of common occurrence have been placed under six headings: Blemishes; Reactions to pressure; Infections of oil glands; Athlete's foot; Animal parasites; and Other inflammations. To read the entire list at one time may be confusing. For the first time, select a few that are of special interest, and leave the others for a later reading.

Blemishes. *Freckles* are spots of pigment in the skin. In fair skins they develop especially after much exposure to sunshine, and permanent freckles are often found in blonds. The only way to prevent them is to protect the skin from excessive sunshine.

A *mole* is a flat or raised spot varying in color from light yellow to black, and sometimes having coarse hairs. Its origin is not known. If a mole is regarded as a disfigurement, a physician should be consulted. Tampering with a mole has been known to produce cancer.

Warts may be harmless outgrowths from the skin, or they may be due to infection. An area of the skin in which the resistance has been lowered through a bruise or some other cause is a predisposing factor. In children, warts sometimes come out in numbers and then suddenly disappear. This sudden disappearance of warts has given rise to a number of the old superstitions regarding their removal. If troublesome warts persist, increase in number, or return after removal, medical advice should be sought.

Reactions to pressure. Continued pressure or rubbing of the skin short of blistering causes the outer layer to thicken into a hard protective pad or *callus.* An extreme illustration is seen in certain African natives who go barefoot. They develop calluses sometimes half an inch thick on the soles of the feet. Calluses are seen on the hands of mechanics and stokers and occasionally develop on the fingers of harp and violin players. They disappear when the cause is removed. A fallen anterior arch often produces a large callus on the ball of the foot.

The pressure of poorly fitting or very tight shoes causes the skin to thicken over the irritated area with gradual formation of a *corn.* This will usually disappear if properly fitted shoes are worn.

Rapid and persistent rubbing on the palms of the hands, as occurs in prolonged use of a broom or snow shovel, or on the foot when the shoe rubs against the heel, separates the outer and inner layers of skin. The space between fills with a clear watery fluid, forming a *blister*. If the outer skin over the blister is in any way broken, a sterile or antiseptic dressing should be applied. The fluid in such a blister is gradually absorbed, but opening of the blister is sometimes necessary to relieve pain. This should be done with a sterile needle (sterilized in alcohol or in a flame) and the broken skin protected by a sterile gauze to avoid infection. The pressure on a blistered heel may be relieved by applying to the area a pad made of gauze or a bunion pad and fastening it with adhesive tape. Care should be taken that the pad does not press upon the blister. A bunion pad can be cut into two half circles if it is too small to span the blister.

Obstruction of oil glands. The openings of the oil glands may become clogged with dirt and oil from the skin, or perhaps by the use of too much cold cream, causing blackheads or whiteheads. Blackheads occur at any age, but are most common during adolescence. Thorough cleaning of the skin twice daily with soap and warm water, followed by a rinse with cold water, will help to remove blackheads. A rough towel should be used for drying the skin. Blackheads that cannot be removed by this treatment should have the attention of a physician.

Pimples and *acne* result from an inflammation of the oil (sebaceous) glands caused by the presence of bacteria. The predisposing causes are improper diet, poor cleaning of the skin, poor elimination, and a generally run-down physical condition. Like blackheads, acne occurs most commonly during adolescence. At this time, the activity of the sebaceous glands is intensified by the internal secretions. Some authorities maintain that the reactions to various foods should be considered in seeking a cure.

A *boil* is a bacterial infection around the root of a hair. The bacteria enter because of some local irritation particularly by the rubbing of clothing such as a soiled collar on the back of the neck. The core is dead tissue, resulting from a cutting off of the local circulation. Boils are more frequent in the spring of the year when body resistance is often lower than at other times as a result of inadequate supply of fresh foods and sunshine during the winter. The tendency to boils is increased by eating rich foods, especially sugar and sweets, and careless cleaning of the skin. The boil should not be squeezed to force drainage. A hot salt solution may be applied to relieve the pain and hasten the formation of pus. (Hot salt solution is made by adding three heaping tablespoonfuls of ordinary salt, or twice this amount of Epsom salts, to a quart of hot water.) The use of salves and poultices may result in spreading rather than lessening boils. To keep the area clean and to prevent further irritation, the boil should be covered with a sterile bandage. If boils are severe or numerous or if they occur frequently, a physician should be consulted.

A *carbuncle* is an infection of a number of adjacent hair follicles. Carbuncles and boils on the face, particularly on the upper lip and nose, should never be self-treated. There is a close relation between the lymph spaces of the face and the cranial cavity, so that carbuncles and boils sometimes cause serious or even fatal infection of the large blood vessels around the brain. Carbuncles occur more frequently in adults than in children.

Athlete's foot. Ringworm of the foot, commonly called *athlete's foot,* is a skin disorder that has become more prevalent in recent years. It gets its name from the frequency with which it is found among athletes. The plant parasite or fungus that causes this disease survives best in such warm, moist places as bathing beaches, shower rooms, or the runways of swimming pools. From the floors of these places it can readily attack moist areas under and between the toes, especially if the skin is cracked. The fungus adheres readily to the feet when they are moist from perspiration or bath water. The first symptom of athlete's foot is scaling and itching between the toes, followed by blisters. These sometimes open, forming a raw surface with swelling and cracking of the infected parts. A physician should be consulted, since treatment is difficult.

To help prevent the spread of athlete's foot among young people, many locker rooms are provided with chemical foot baths, and the floors of locker rooms and shower rooms are washed with a chemical solution. Persons found to have clinical cases of athlete's foot are excluded from the showers until they are cured. By careful washing and drying between the toes and by wearing clean hose, one can lessen the likelihood of contracting athlete's foot. This infection also often occurs on the hands. Like other fungous infections, it may occur on the face, under the arms, or on other parts of the body.

Another disorder of the foot which calls for expert care is what is known as *plantar wart*—a thick, hard lump on the sole of the foot, caused by an infection. It is often best treated with X rays or radium.

Animal parasites. *Scabies* or one type of itch is caused by a tiny mite that burrows into the skin. The affected area becomes red, and burns and itches severely. Sulphur ointment will kill the mites, and a bath with warm water and a good, pure soap will rid the body of the dead parasites. The treatment should be repeated in five to seven days, so as to destroy any young.

Head lice may be acquired from a cap or comb of an infested person, or from backs of theater seats. Lice are more common among children in the elementary grades than among those of high school age. One should not feel that he is disgraced by finding head lice on his person, but people look with disgust on the person who provides a permanent home for them. Several preparations for removing head lice may be purchased. When applying any of these medicines, it is important that the eyes of the person being treated are covered so as to protect them. The solution is then applied thoroughly to the hair, and a stocking cap or other head covering is worn overnight. The medicine is applied again the next morning, left on for the day, and reapplied the second night. At the end of the second day or about forty-eight hours after treatment is started, the hair is shampooed. A hot vinegar rinse after the shampoo will loosen the nits so that they may be combed out. If nits are still present in a week the medicine should be used again. Caps, scarves, and similar clothing and bedding must be washed to get rid of lice and nits.

Other inflammations. *Cold sores* or *fever blisters* (caused by a filterable virus, see p. 383) often form around the mouth and on the lips in connection with a cold or after excessive exposure to sunlight. They may be very annoying, but no serious harm usually results from them if they are let alone. Picking may cause them to become infected by staphylococci or other bacteria. Spirits of camphor or alcohol may be beneficial if applied when the sores first appear.

Another skin irritation that causes considerable discomfort is *hives.* Some people are sensitive to certain foods, and hives frequently result from the use of foods to which the individual is sensitive. After a physician has made the necessary tests, it may be possible to exclude the offending food from the diet. Strawberries and shellfish are common offenders causing hives, although eggs, cream, pork, mushrooms, tomatoes, celery, and many other foods may at times be responsible. Hives may also come from the use of certain drugs or the sting of insects.

Impetigo is a contagious inflammatory disease of the skin. It is found more frequently in children than in adults and is most serious in babies under eighteen months of age. It spreads from one child to another. The infected skin becomes covered with blisters filled with pus. The blisters break open and dry upon the skin to resemble "stuck-on" crusts. Ointment prescribed by a physician is necessary to stop this disorder. Cleanliness of the hands is necessary to prevent spread of the disease to other children.

Eczema is a name applied rather vaguely to a number of skin inflammations. The nature and cause of eczema are difficult to determine. The disease is not infectious but is thought to be an emotional problem. Its presence indicates obscure feelings of tension and inadequacy. Eczema may also arise from irritation by heat, pressure, or chemicals. Patent salves should be avoided, and the family physician should be consulted if the disease persists.

Rashes. Skin eruptions occur also in such diseases of the whole body as smallpox, chicken pox, measles, and scarlet fever. The general nature of these diseases will be discussed in the chapter on communicable diseases (see chap. 25).

In conclusion

THE skin, like the heart, lungs, or stomach, is an organ of the body. It responds to and is affected by changes in circulation, waste products, bacteria, and poisons, very much like other parts of the body. Fundamental changes in the nutrition of the skin can come only from within the body, as the skin cannot be fed through external applications. For the majority of young men and women, careful observance of the laws of health will be sufficient to keep the skin in good condition. If serious disturbances occur, they should not be self-treated. The cause may be deep-seated, and expert advice may be necessary.

Activities

1. Make a fingerprint. Press the side of one finger tip down on an ink pad and roll the finger to the other side. Do the same for the re-

maining fingers. Then press the inky fingers, one at a time with the same rolling motion, on a clean piece of paper and lift them without rolling them back. What causes the ridges or dots? Point out the similarities and differences in the prints. Compare your fingerprints with those of other members of the class.

2. Study the sensitiveness of the skin. Blindfold a pupil and test various areas of his skin with the points of dividers or compasses. How near can the points be brought together and still be felt as two? Test the fingers, the back of the hand, the arm, the forehead, and the back of the neck. Where does the skin seem most sensitive? Show that a needle thrust into the epidermis causes no pain or bleeding.

3. Study the effect of evaporation on skin temperature. Place a few drops of ether or alcohol on the back of your hand. What sensation do you feel as the liquid evaporates?

4. Wash your face with pure soap and plenty of warm water twice a day for a week and notice the effect.

5. Collect suggestions for the care of the skin from newspaper and magazine advertisements. Determine which are correct, incorrect, and which are extravagant in their claims.

Tests

I

Directions: On a separate piece of paper make a list of letters from A to J, corresponding to the letters of the definitions given below. After each letter place the number of the term in the list below which best fits that definition. Do not write in the book.

A. A modification of the horny layer of the skin.
B. A natural pigmented area in the skin unrelated to disease.
C. A contagious skin infection due to a parasitic fungus.
D. A substance that is most important in aiding the body to maintain a constant temperature.
E. Blocking of a sweat duct caused by an accumulation of dirt at the mouth of the pore.
F. A preparation that may be safely used in keeping the skin in healthy condition.
G. A skin blemish that may become cancerous when subject to irritation.
H. A tonic to the skin.

I. An inflammation of the oil glands aggravated by improper diet and poor cleaning of the skin.

J. A contagious, inflammatory disease of the skin manifested by blisters filled with pus.

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1. blackhead
2. ringworm
3. soap (low alkali)
4. freckle
5. sweat
6. mole
7. nail
8. acne
9. cold bath
10. impetigo
11. blister
12. sunburn
13. complexion cream

II

Directions: On a separate sheet of paper write the numbers from 1 to 9, corresponding to the numbers of the practices given below. Place a check mark (√) to the left of the numbers indicating the practices which you consider good, and to the right of the numbers give the reasons for your choice as derived from this chapter. Do not write in the book.

Henry, during the past three months, has been troubled with a large number of pimples on his face. His skin is quite oily, but he has always been in apparently good health. He has learned that this condition is called acne. What should Henry do to clear up his skin?

1. Cut down on the amount of carbohydrate in his diet.
2. Eat yeast at least twice a day.
3. Use cold cream on his face until the disorder clears up.
4. Clean his skin thoroughly twice daily with soap and warm water, followed by cold water.
5. Avoid constipation by eating plenty of fresh fruit and vegetables.
6. Take some advertised blood medicine.
7. Use fine talcum powder on his skin.
8. Have a thorough physical examination by his family physician.
9. Try to forget about the condition and let nature take care of it.

Associated subjects

Biology: The relation of cleanliness and of one's dietary habits to the health of the skin, and the relation of germs and molds to the spread of skin disorders. . . . The habits of animals, such as cats and dogs, that may be responsible for fungous diseases. . . . The relation of allergy to skin disturbances.

Chemistry: The chemical analysis and manufacture of skin preparations.

Home economics: The use of diets containing iron and vitamins that may improve the health of the skin. . . . The effects of various foods on the skin. . . . The importance of proper grooming. . . . The relation of facial coloring to cosmetics. . . . Clothing and body heat.

Physical education: The use of first-aid treatment for skin disorders. . . . Proper techniques of bathing. . . . The value of exercise.

Physics: The scientific facts that oxidation produces heat and that evaporation produces a cooling effect. . . . The conduction and radiation of heat.

Social science: Necessity for adequate legislation regarding quarantine and false advertising of foods, drugs, and cosmetics.

References

ALLEN and BRIGGS. *Behave Yourself!*
AMIDON, BRADBURY, and DRENCKHAHN. *Good Food and Nutrition.*
DALY. *Pretty, Please.*
HAWES. *Good Grooming.*
MEREDITH. *Health and Fitness.*
RATHBONE, BACON, and KEENE. *Health in Your Daily Living.*
TRILLING and NICHOLAS. *You and Your Money.*
TURNER. *Personal and Community Health.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*

Film

The Human Skin. 11 minutes, sound. Bray Studios.

5. *GLOSSY HAIR IS HEALTHY HAIR*

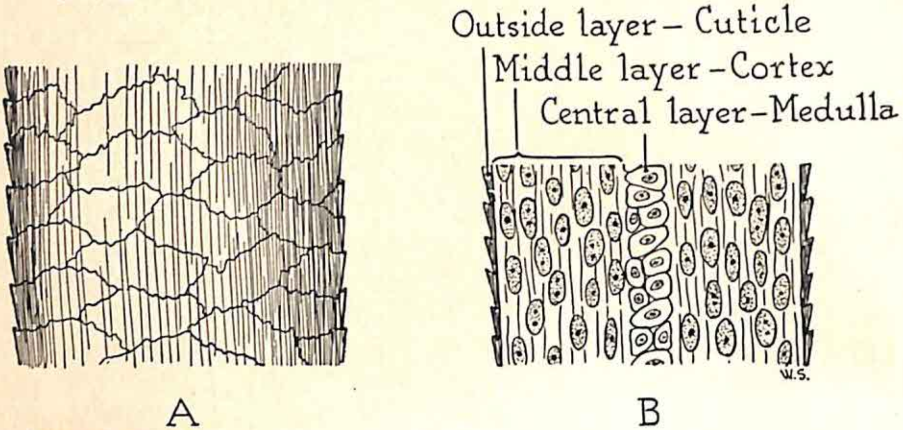
ONE of the distinguishing marks of an attractive person is a head of healthy, glossy hair. Whether or not you have abundant, well-groomed hair is partly a matter of heredity and partly a matter of care. The hair, like the skin, may be regarded as an index to health.

Do you know . . .

1. *How one can improve the appearance of the hair?*
2. *What makes hair look dead?*
3. *Why hair is thicker on some heads than on others?*
4. *Why some hair is stiff and other hair is soft?*
5. *How natural oil is supplied to the hair?*
6. *Why some hair is naturally curly and other hair is straight?*
7. *If the use of flaxseed, vinegar, lemon juice, or egg white makes hair wavy?*
8. *How often hair should be washed?*
9. *What effect hard water has on the hair?*
10. *Which is better to use, soap or a special shampoo?*
11. *Why hair does not stay in place after washing?*
12. *If oily hair is a sign of health?*
13. *If the application of olive oil improves the hair?*
14. *If vaseline and other substances used to keep hair in place harm it?*
15. *How brushing benefits the hair?*
16. *What causes falling hair?*
17. *How dandruff can be avoided?*
18. *If tight hats cause baldness?*
19. *If hair turns gray or falls out after a severe fright?*
20. *What causes gray hair?*
21. *If wave-set preparations, shampoos, and lotions are harmful to the hair?*
22. *Whether permanent waving or curling with an iron harm the hair or the scalp?*
23. *Whether hair tonics help to improve the hair?*
24. *What the effects are of dyes on the hair?*

Structure of the hair. Examination of a hair under the microscope shows that it consists of three layers:

The outside layer—for protection—is composed of smooth, flat, transparent cells overlapping one another very much like shingles on a roof.



A SHOWS a human hair magnified; *B* shows a lengthwise section of a hair shaft.

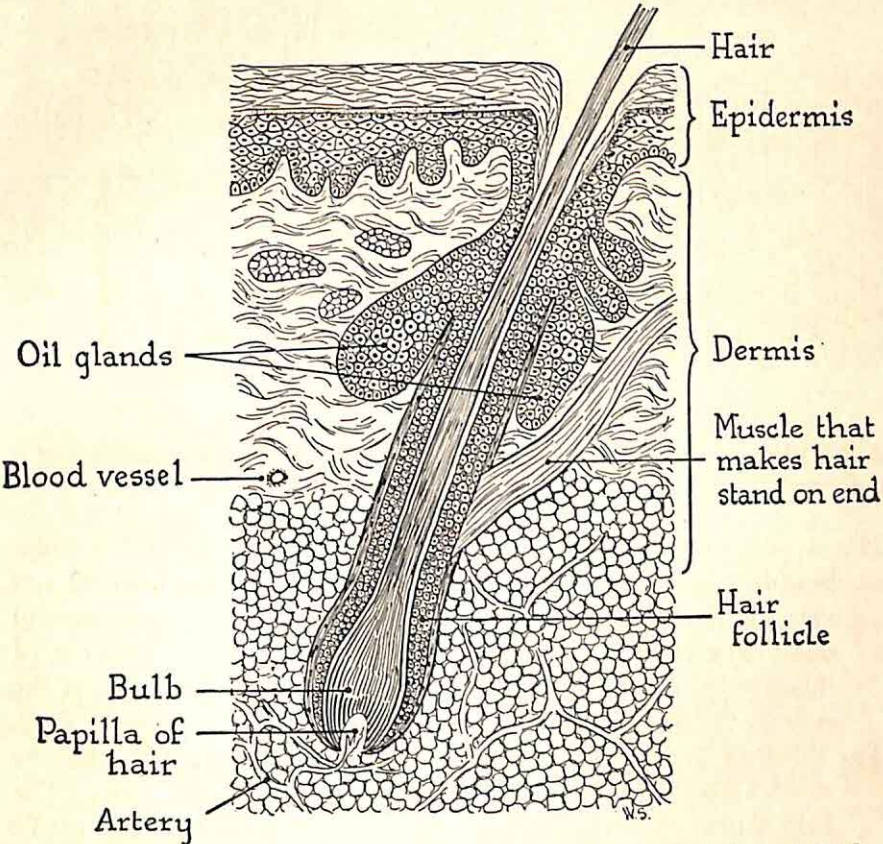
The second, or middle, layer has elongated cells which make the hair flexible. In this layer there are small openings that hold oil and give the hair its luster. Without this oil, the hair looks dry and dull. The color of the hair, like that of the skin, is a matter of inheritance. The pigment lies in the middle layer. When the cells in this layer cease to deposit pigment, the hair becomes gray.

The third, or central, layer consists of two rows of cells placed side by side lengthwise of the shaft. It may be absent in many hairs. The hair is not hollow, as is commonly believed. The far ends of the hairs are dead, resembling in this respect the outer layer of the skin. This fact should be remembered when singeing is proposed "to prevent the hair from bleeding."

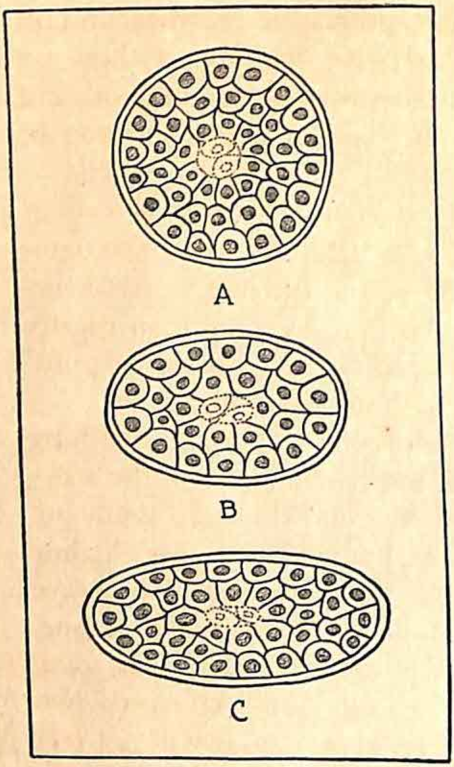
In both the middle and central layers there are tiny air spaces between the cells. The presence of a large amount of air in the hair makes it appear lighter in color or even white.

Near each hair root are one or two oil glands, opening on to the skin where the hair comes out. The oil from these glands is necessary to keep the skin flexible and the hair oily, and to prevent breaking of the hair. The amount of oil produced by the scalp varies in different individuals. Some scalps are dry; others are very oily.

How hair grows. Each shaft of hair has at the root a swollen base, resembling a bulb or bowl, which fits over an elevation in the inner layer of the skin. Through this bulb the hair gets its blood supply and nourishment. This is the only point at which the hair lives and grows. Hair grows at the rate of about half an inch a month. The common notion that cutting off the ends of the hair—either by shaving the head or trimming the hair with scissors—causes the hair to grow faster and stronger is false. This cutting may stop the splitting of hairs and thus prevent the wearing away of the hair. But there is no evidence that baldness may be prevented in this way.



THIS SECTION of the skin, greatly magnified, shows a hair in its follicle.



CROSS-SECTION views of three kinds of hair show the difference in that of the Mongolian (*A*), the Caucasian (*B*), and the Negroid (C) races.

A fine muscle is attached at the base of each hair. Cold or fear may contract these muscles and cause the hairs, which are usually in a slanting position, to stand on end. "Goose flesh," which occurs when the skin is chilled, is also caused in this way. The tendency for the hair to stand erect is very marked in the cat when she "gets her back up."

Straight hair or curly hair. Whether hair is straight or curly depends upon the shape of the individual hairs. If hair is straight, an individual cross section of the hair shows it to be nearly round; while if hair is wavy, the cross section is oval. A cross section of natural kinky hair shows it to be even more flattened. It is the shape of each hair, then, that gives some individuals very curly hair, while other individuals have great difficulty in maintaining any curl at all.

Vinegar, lemon juice, flaxseed, or egg white cannot make hair wavy. Vinegar and lemon juice may, however, help to remove alkali and oil in shampooing, especially when the water is hard.

Managing the hair. Hair may be coarse in texture or very fine. Very coarse hair may be hard to manage because of its stiffness, and very fine hair, because of its softness.

It has been estimated that the average scalp contains about 120,000 hairs. Fine hair does not seem as abundant as coarse hair.

The shampoo. Hair should be kept clean. Unfortunately there is a popular idea that frequent washing of the hair is harmful.

Some persons think that loss of hair, premature grayness, and all sorts of hair ailments are due to excessive washing. Others say that frequent washing of the hair destroys the natural oil and luster, increases dandruff, breaks the hair, or causes splitting of the ends of the hair.

Washing removes the oil from the hair itself, but it cannot touch the oil glands. With the oil, goes the luster. If hair is naturally dry, frequent shampooing may cause the hair to break because of the lack of oil. This danger, however, has been greatly exaggerated. The glow of clean, healthy hair is more beautiful than the shine due to oil, whether natural or out of a bottle.

The scalp, like the rest of the skin, requires thorough washing with soap and water. In washing the hair and scalp, the soapsuds should be rubbed with the fingers into the scalp itself, not merely into the hair. Any good soap that is not strongly alkaline may be used. The washing is more thorough if two successive soapy waters at moderate temperature are used instead of one.

Rinsing and drying the hair. The most neglected part of a shampoo is usually the rinsing. The hair should be rinsed two or more times. When the hair is free from soap, it will not feel smooth but will give a little squeak as the hands are rubbed over it. The rinsing is not complete until this stage is reached. A proper shampoo cannot be completed in a few minutes.

Warm but not hot water should be used, finishing with cool but not cold water. Hard water should be avoided, if possible, since the alkali in hard water is just as undesirable as the alkali in soap.

The hair should be dried as quickly as possible with towels or, in summer, in the hot outdoor sun and wind. If a drier is used, the heat should not be too great. In cold weather one should not go out until the hair is completely dry. Short hair is easily washed and dried, and in that respect it is preferable to long hair.

Frequency of the shampoo. Hair should be shampooed as often as is necessary to keep the skin and scalp clean. For boys, a daily shampoo will do no harm. The extra massage resulting from the shampoo may actually increase the formation of oil. For girls, a shampoo twice a month will be enough, if the hair is well brushed twice daily. Plastering down the hair with oil or vaseline is undesirable because oily hair tends to collect dirt. A good rule is to keep the hair clean, no matter how often it has to be washed. If the scalp is especially dry after shampooing, one may rub in only a few drops of oil or grease, such as pure liquid vaseline or olive oil.

Daily care of the hair. Hair should be brushed thoroughly every day to remove dust, dirt, and dandruff, and to distribute the natural oil. Brushing the hair vigorously also stimulates the circulation of the blood in the scalp. It does not cause the hair to fall out; it merely removes those hairs that are ready to fall out and stimulates the growth of new ones.

Each person should have his own brush and comb. A stiff brush is better than a soft one, although it should not be so stiff as to injure the scalp and possibly lead to infection. To keep the brush clean, wash it with soap or ammonia and water and expose it to the sun or dry it promptly by the stove or radiator. The comb should not be so fine that it causes tangles, nor so sharp and rough that it injures the scalp. Wetting the hair when combing is not objectionable if the hair does not become too wet to dry quickly.

Combing the hair is just as important for boys as for girls but should not be done by either in public. Boys should not allow their hair to become too greasy, and they should have a haircut or shave as often as good grooming requires.

Improving the hair. When a dog's fur becomes rough and sheds hair, one does not buy a hair tonic to make it thick and glossy. One knows enough about animals to understand that such difficulties indicate that the dog's diet is wrong or that the dog is not in good health. Why not conclude the same thing about a person's hair if it does not look healthy? Hair that is not abundant or attractive will improve in appearance through proper care and good health habits.

Baldness. All the time, some hairs are falling out and being renewed. There is no cause for alarm unless hair falls out more rapidly than it is being renewed. Baldness is more common in men than in women. Like premature grayness, baldness seems to run in certain families. Baldness may also be associated with the functioning of the ductless glands. There is no positive proof that baldness may result from wearing a hat too tight or too continuously.

The growth and strength of each individual hair depends on an unfailing supply of blood. In some serious illnesses the reduction in general vitality is accompanied by loss of hair.

Dandruff is sometimes considered a cause of baldness. Circulation can be stimulated by massage, and the scalp should be kept clean by brushing daily and by shampooing at least every two weeks. The tendency to have dandruff may be diminished by keeping the scalp as healthy as possible.

Dandruff. On a healthy scalp there is a slight shedding of worn-out cells but no accumulation of oily material. This scaling off of cells from the skin is a normal and healthy process. Dandruff consists of these scales with an excess of oil secreted by the oil glands. If the scales are dry, they may be easily rubbed or brushed from the scalp; but they sometimes cake and adhere closely. If dandruff appears, the scalp should be kept as clean as possible by means of a daily massage and a weekly shampoo. Sometimes dandruff is due to a disease of the scalp, and medical attention is then necessary. Dandruff is not merely a social handicap, as advertising of the various nostrums would lead one to believe, but may sometimes be regarded as a symptom of unhygienic living.

Curling the hair. If combs or pins can bring out the natural curl, they are probably better for the hair than curling irons or a "permanent" wave. So far there has been no satisfactory research to determine the value and safety of the various devices on the market for waving the hair; but the permanent wave, when carefully done, is believed to have no harmful effect on the hair. Apparently, much depends on the skill of the operator and the quality of the materials used. Hair that is overbaked becomes dull and brittle and tends to break off. This effect, however, is temporary, and in most cases the new hair which grows out is normal.

Changing the color of hair. Many people object to having gray hairs; some even dislike the natural color of their hair. In spite of the many advertisements, there is no means of restoring the hair to its natural color. Tints and dyes create unnatural contrasts between the color of the eyes and skin and that of the dyed hair. The risks involved in the use of such preparations are great, and the results are artificiality and unattractiveness.

Hair dyes are among the oldest and most dangerous of cosmetics. These dyes, which are either aniline or metallic, may cause general poisoning or irritation that has been known to extend from the scalp to the face. The substances used for bleaching hair contain hydrogen peroxide, sodium perborate, or ammonia.

Both bleaches and dyes leave the hair dry and brittle and may cause it to fall out. As the hair grows, the old color appears again at the roots, so that the bleach or dye must be reapplied frequently, with increased risk of poisoning.

Removing hair. Hair removers or depilatories contain sulphide compounds which, when used on the skin, act like strong alkalies They not only dissolve the hair, but the skin as well, so that irritation or infection may result. If left long enough to be effective, the chemical action may cause a serious burn, rash, or other skin trouble. Shaving is the only safe method of temporarily removing hair.

Sometimes superfluous hairs which cause much distress occur on the face of women. The best method for removing these hairs is to apply the electric needle to the root of each hair separately. However, only an expert skin specialist should be allowed to do this.

Other hair preparations. "Dry cleaning" hair preparations contain liquids that are highly inflammable. Their solvent action on fats and oils makes the hair brittle and the scalp very dry.

Hair tonics and liquid shampoos have no particular value and usually contain a simple, inexpensive ingredient sold at a high price. Any benefit that is apparent comes primarily from massage in applying the tonic. Scalp foods are sometimes successfully used to stimulate the circulation, but they do not nourish the hair. Such preparations should not be used without the advice of a physician.

Protect yourself. Since the passage of the Federal Food, Drug, and Cosmetic Act (see p. 358), the sale of all dangerous cosmetics except poisonous coal-tar hair dyes is prohibited. Poisonous hair dyes must carry a warning label. This law, however, does not protect against false advertising. The advertisers of hair tonics and other preparations used on the hair are inclined to make extravagant claims that cannot be established. It is safest to refuse any patent preparation whose label does not bear a clear statement of the ingredients.

In conclusion

HEALTHFUL living will correct most difficulties concerning the hair unless they are due to some deep-seated cause. For most persons, well-groomed hair does not mean permanent waves, marcels, tinting, and dyeing, but implies habits of cleanliness and daily care. Most advertised beauty aids are detrimental to the texture and natural beauty of the hair.

Activities

1. Take proper care of your hair for one month and decide whether or not the result was worth the extra care.

2. Evaluate advertisements in newspapers and magazines of products sold for the care of the hair. Try to determine which ones are correct, incorrect, or extravagant in their claims, and which ones contain the endorsements of prominent people rather than scientific information.

Test

Directions: There are five incomplete statements in this test (A, B, C, D, and E), each followed by a varying number of parts. One or more of these parts, or perhaps none of them, correctly completes the incomplete statement. On your paper copy the five letters and the numbers of their parts in a vertical column. Place a plus sign (+) after the number of each part that correctly completes the statement. Do not write in the book.

A. Luster of hair depends on
  1. color.
  2. fineness of texture.
  3. oil secreted from a gland at the base of the hair.
  4. shape of each hair.

B. Hair improves in appearance through
    1. daily care and cleanliness.
    2. use of hair tonics.
    3. massage of the scalp.
    4. proper health habits.
    5. tinting or dyeing.

C. Baldness
    1. may occur after a serious illness.
    2. can be cured by shaving the head.
    3. is prevented by going bareheaded.
    4. is sometimes hereditary in men.
    5. is due to frequent washing of the hair.

D. Dandruff
    1. is a slight shedding of worn-out cells of the skin.
    2. is a symptom of unhygienic living.
    3. is scaling of cells of skin with excess oil from oil glands.
    4. is always a disease of the scalp.

E. A good shampoo should include
    1. rubbing soapsuds into the scalp.
    2. rinsing the hair and scalp two or three times.
    3. application of a tonic.
    4. a lemon or vinegar rinse.
    5. thorough drying.

Associated subjects

Biology: The fact that in man, hair is not so important a factor in protection as in other animals. . . . The structure and origin of hair.

Chemistry: The manufacture of soap. . . . The analysis of water and commercial shampoos. . . . The harmful effects of free alkali.

Social science: The dangers of unscrupulous advertising and the need for adequate legislation concerning skin and hair preparations.

References

Brownell and Williams. *The Human Body.*
Clemensen and LaPorte. *Your Health and Safety.*
Goodman. *Your Hair.*
Williams. *Healthful Living.*

Film

The Human Hair. 11 minutes, sound. Bray Studios.

6. *CLEAN HANDS ARE ALWAYS SAFE HANDS*

MAN'S mental superiority is related to his hands with their flexible fingers and apposing thumbs. As the hand is closed, the inner surface of the thumb approaches the fingers. This position of the thumb makes it possible for him to do many things with his hands. Such movements as the handling of the tiny parts in repairing a watch, the playing of a musical instrument, or the manipulation of a big machine, all require skillful use of the hands.

Hands, because they are constantly in use, are easily soiled. Keeping them clean requires special care and attention.

Clean hands suggest refinement. Dirty hands, with nails that have been neglected, are a serious handicap in society and business. Your hands should be cared for, not only for esthetic reasons, but also in the interest of good health.

Do you know . . .

1. *How clean hands are related to health?*
2. *How chapping of the hands can be prevented?*
3. *Why the hands become dry and hard as a result of being in water for a long time?*
4. *Why the nails should receive special care?*
5. *How hangnails can be prevented?*
6. *How infection can develop from hangnails?*
7. *How nails should be trimmed?*
8. *Why a nail is sometimes lost after the tip of the finger is pinched?*
9. *What causes white spots and a rough surface on the nails?*
10. *Why surgeons protect their hands with rubber gloves?*
11. *How the fingernail grows?*
12. *How frequently hands should be washed?*
13. *Why the fingers should be kept away from the mouth, the nose, and the eyes?*
14. *How long it takes for a fingernail to replace itself when injured?*
15. *That nails which are too long interfere with the skillful use of the hands?*
16. *That the skin inside the hands is very tough?*
17. *Why the hands should be dried thoroughly after washing?*

Courtesy H. Armstrong Roberts

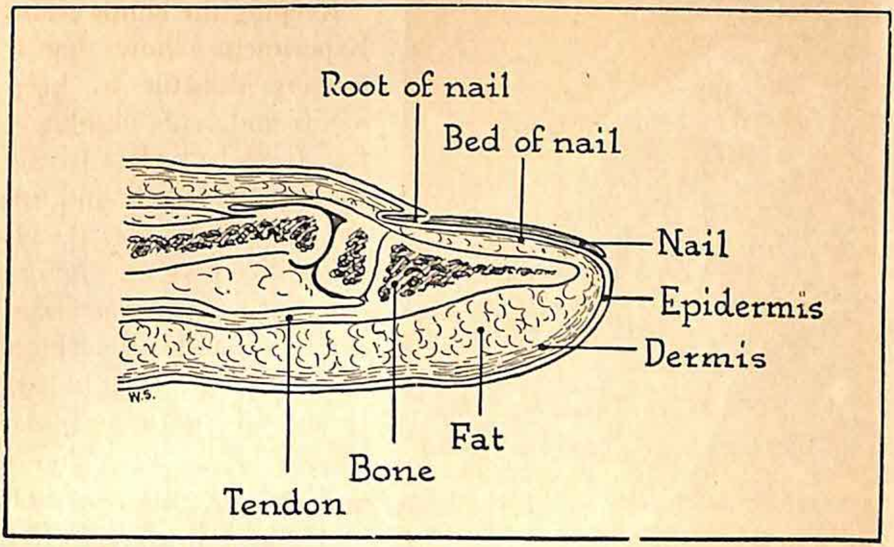
THE EXPRESSIVE beauty of a girl's well-kept hands results from careful attention. But more important, clean hands aid in keeping healthy.

Keeping the hands clean. Experiments show that it is very difficult to keep hands and nails absolutely free from bacteria. In the folds of the cuticle and under the nails there is always some dirt present. Before beginning an operation, surgeons scrub all surfaces of the hands and fingers thoroughly with a special soft or liquid soap and a sterilized brush so that their hands may be as free from bacteria as possible. Even though rubber gloves are worn during the operation, this scrubbing is still necessary in order to lessen the danger of infection from bacteria on the hands in case a glove should happen to tear.

It is not a good or safe habit to put the fingers in the mouth or nose, or to use them to rub the eyes or scratch the skin. However, the danger of infection through the unbroken skin is slight.

The skin of the hands is much tougher than the skin of the face, and so can stand much scrubbing. The hands should be washed several times a day with warm water and soap, and the nails and finger tips should be scrubbed with a brush of moderate stiffness. The brush should be dried promptly after using and be drained by standing on its bristles. Everyone should have his own individual toilet articles.

If the soap is rinsed off well and the skin is wiped entirely dry, the hands will not chap. If the hands are kept a long time in warm water containing soap, much of the oil is washed away and the hands feel dry and hard. Rubbing with olive oil or a good hand lotion will soften the skin and relieve the dryness.

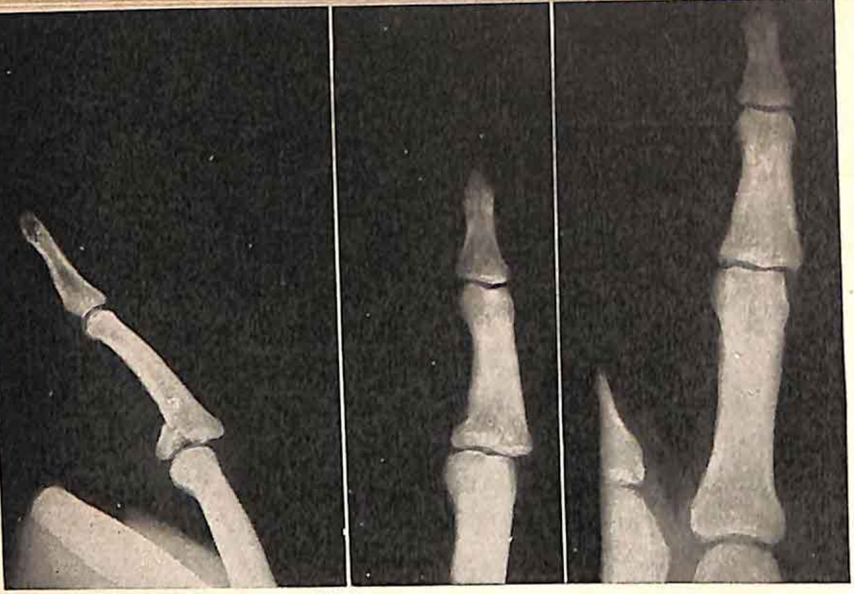


THE NAIL is closely related to the other parts of the finger, as shown by this large diagram of a section through the end of a finger.

The hands should be washed not only when they look dirty but also at other times, especially before and after eating and after going to the toilet. This serves as a protection against the spread of harmful bacteria.

The growing nail. The nail may be regarded as a very wide, flat hair, growing from its root at the lower end of the nail and from the bed of the nail. The root is well embedded in a fold of inner skin. The cells in both the root and the bed of the nail are constantly developing. In this way the nail grows in thickness and length and serves as a protection to the finger or the toe. In case of injury, the nail can replace itself if the cells that produce it are not damaged. A nail replaces itself normally in three or four months.

If the outer skin is pressed back at the root, the nail may not be perfectly nourished and a white speck or flaw is formed. This speck travels slowly with the growth of the nail. Sometimes transverse grooves also appear on the fingernails. These are caused by thinning of the nail, corresponding to periods of sluggish growth. Proper development of the nails depends on proper diet, general care of the body, and a healthy blood supply.



Courtesy Frank B. Stephenson, M.D.

IN AN X-RAY PHOTOGRAPH of the bones of a broken finger, we can easily see the break and dislocation at the second joint. *From left to right*: side view, oblique view, back view.

The manicure. The fingernails are so formed that they collect a good deal of dirt. Proper care of the nails involves keeping them clean with a brush and fairly short and smooth with scissors and nail file. Dirt can be removed most easily after each washing, while there is still moisture under the nail. It is undesirable to clean the nails with a sharp-edged instrument, such as a knife, because the undersurfaces will be roughened, making them more likely to catch and hold dirt, and also because of the danger of injury to the bed of the nail.

After washing the hands, the skin or cuticle about the nails may be pushed back gently with the towel or with a blunt orange stick. Otherwise the skin clinging to the nail may be torn away as it grows, thus causing a hangnail. This is one of the most annoying defects of the fingernail, since bacteria may get in and produce a painful or even dangerous inflammation. Hangnails are also caused by cutting the skin with scissors.

When a hangnail forms, it should not be pulled away but should be trimmed away carefully. If the cuticle has begun to split, apply iodine to the rough edge so as to prevent inflammation. Olive oil or a good cold cream applied at night will keep the skin around the nails soft if it tends to become too dry.

Trimming the nails. For convenient use, the nails of the fingers should be cut so as to follow the natural curve of the finger tips. They should then be filed smooth at the corners and along the edge so that a narrow white margin extends beyond the red bed of the nail. If nails are allowed to grow too long, they break more easily and also collect a great deal of dirt. Not only are the extremely long fingernails, at present affected by many women and girls, unsanitary, but they obviously interfere greatly with many forms of activity in home, office, and factory.

Undesirable practices. Biting the nails is very unhygienic, as well as repulsive to others. When the cuticle around the nail, or the nail itself, is rough as a result of this bad practice, the appearance of the hand is spoiled. Biting the nails is frequently due to a lack of self-control. The temptation may be reduced by keeping the nails smooth and by pushing back the skin to avoid hangnails. The habit of biting the nails is often found in undernourished or nervous persons.

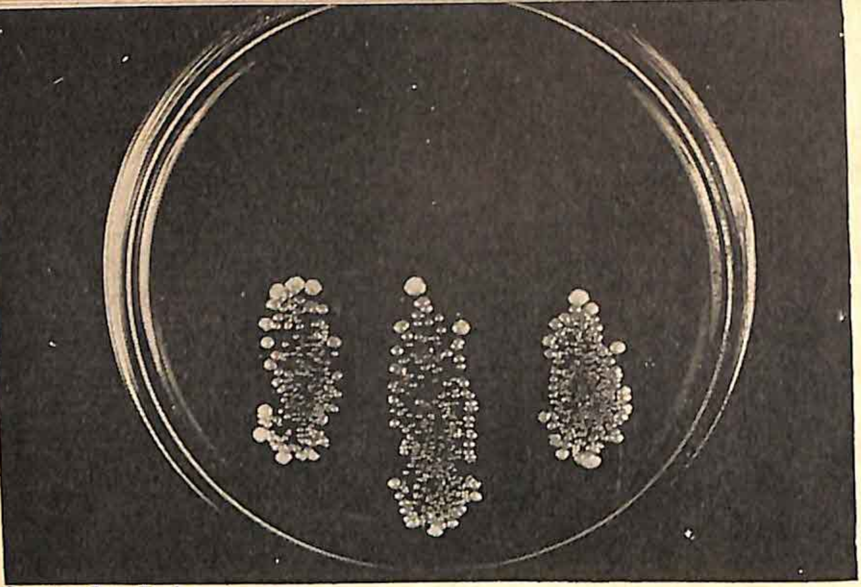
According to the best standards of etiquette, the toilet should be completed in one's room. Cleaning the nails, combing the hair, or applying cosmetics on the street or in public places is not polite practice and is often annoying to others. Applying powder or lipstick in the dining-room may be particularly offensive.

Hand lotions and nail preparations. The chief objection to the much-advertised hand lotions is their high price. Hand lotions that contain glycerine may be harmful to some skins because of the tendency of glycerine to absorb moisture from the skin.

Very little scientific study of nail preparations has been made, but it is generally believed that they are harmless. Cuticle removers contain caustic potash which is likely to dry and irritate the skin around the nails and to cause hangnails. Polish removers contain acetone, a chemical lacquer solvent which also dissolves the natural enamel on the fingernails.

In conclusion

THE hands come in contact with many things, collecting dirt with all kinds of bacteria. The habit of keeping the hands clean and the nails trimmed is one of the essentials of healthy living.



Courtesy Inez Taylor

THIS IS WHAT resulted from pressing three unwashed fingers against an agar plate. Each small spot is a colony developed from bacteria left by a finger.

Rough-looking hands with long, dirty fingernails mark a person as being careless in his habits. In general, the way in which one daily uses and cares for his hands stamps the individual.

Activities

Determine the effect of thorough washing of the hands on the presence of bacteria. Prepare three Petri dishes of sterile agar. (Refer to a textbook on biology or bacteriology.) Keep one Petri dish for a control to show that the agar is sterile. Lift the cover of the second dish long enough to touch the surface of the agar with the tips of the fingers. Then, using a nail brush, wash the hands thoroughly with warm water and soap. Dry the fingers in the air, and then lift the cover of the third dish long enough to touch the surface of the agar with the tips of the washed fingers. Place the covered dishes in a warm place for 48 hours. Compare the number of spots or colonies of bacteria in the three dishes. Does a thorough washing of the hands reduce the number of bacteria?

Test

Directions: The six statements which follow, numbered 1, 2, 3, 4, 5, and 6, are interpretations of the experiment suggested in "Activities." On the basis of the *conditions observed,* consider each statement. On a separate paper, copy the six numbers in a vertical column. If the statement is true, mark with **T**; if it is false, mark with **F**; if there are insufficient facts, mark with **I.** Do not write in the book.

Let Plate 1 be the control Petri dish; Plate 2, the dish exposed to the unwashed fingers; and Plate 3, the dish exposed to the washed hands. Assume that after 48 hours the following conditions are observed:

Plate 1: No change was apparent.
Plate 2: Small white and yellowish spots were visible.
Plate 2: Two large white fuzzy spots also were easily seen.
Plate 3: One large white fuzzy spot was seen.
The small spots were colonies of bacteria (under compound microscope).
The large spots were growths of mold.

Interpretations

1. Unwashed fingers carry bacteria and mold spores.
2. Fingers thoroughly washed are relatively free from bacteria.
3. Fingers thoroughly washed may carry mold spores.
4. Dirt is always a source of bacteria.
5. An agar plate exposed to unwashed fingers will always develop colonies of bacteria.
6. Washing the hands does not remove all bacteria.

Associated subjects

Biology: The demonstration of the presence of bacteria and mold spores to illustrate the necessity for keeping the hands absolutely clean.

Chemistry: The analysis and making of nail preparations and hand lotions.

Home economics: The demonstration of the care of the hands by manicuring.

References

CLEMENSEN and LAPORTE. *Your Health and Safety.*
MEREDITH. *Health and Fitness.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Film

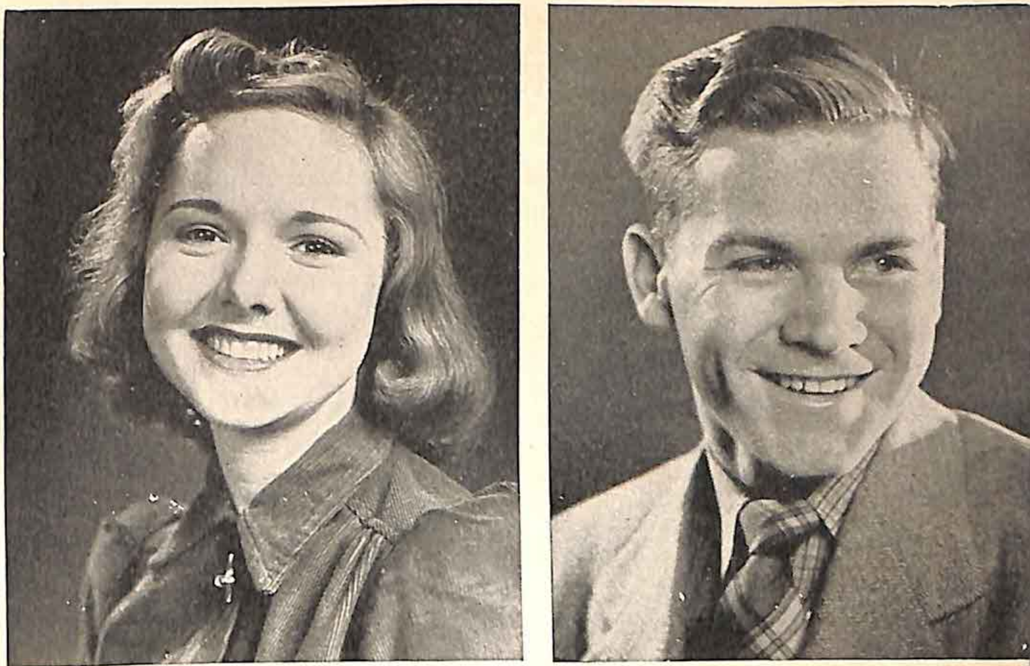
Cleanliness and Health. 10 minutes, sound. Coronet.

7. *YOUR TEETH INFLUENCE YOUR WHOLE BODY*

YOUR teeth, which you may think of only as biting pegs, are very important in regard to your health, comfort, and appearance. If they do not grind your food well, a disturbance in digestion may follow. Very slight injury to a tooth may eventually cause you considerable pain. If you are so unfortunate as to lose a front tooth through decay or injury, you are embarrassed at the change in your appearance. You may even have difficulty in speaking clearly. A clean mouth with a full set of sound teeth is an important factor in personal attractiveness. More important, however, is the influence of teeth on the health of the body.

Do you know . . .

1. Why one should take care of the teeth?
2. How teeth perform one of the most important functions in the body?
3. What effect bad teeth have on health?
4. Why teeth decay?
5. Why people have their teeth extracted?
6. What causes an abscessed tooth?
7. Whether the kind of food eaten affects the condition of the teeth?
8. If the condition of the teeth causes bad breath?
9. What causes pyorrhea?
10. Why proper development of the first set of teeth is important?
11. What eyeteeth and stomach teeth are?
12. Why tooth braces are sometimes necessary?
13. What is meant by dental occlusion?
14. How fluorine in drinking water affects the teeth?
15. What is the first permanent tooth to appear?
16. Where tartar usually forms on the teeth?
17. How to brush your teeth correctly?
18. Why food particles should not be allowed to remain between the teeth?
19. How to prepare an inexpensive mouthwash?



Courtesy Harold M. Lambert

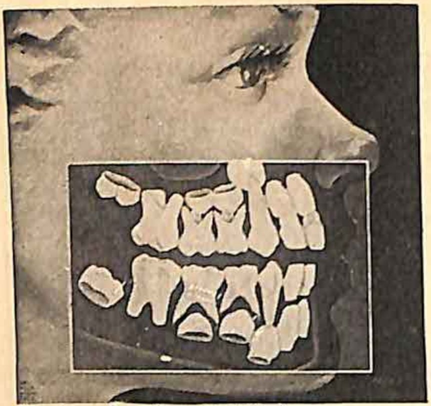
YOUR SMILE will reflect your personality better if it reveals clean, well-cared-for teeth.

Three uses of teeth in man. Teeth are used for biting, cutting, and grinding. Gnawing animals, such as the beaver, have front teeth for cutting. Flesh-eating animals, such as the dog, have only tearing or biting teeth. Some of the grass-eating animals, such as the cow, have flat, grinding molars. Human beings have all kinds. In each jaw there are

Four incisors, or sharp, cutting teeth, in front.
Two cuspids, for tearing, one on each side.
Four bicuspids, for grinding, two on each side.
Six molars, or flat, grinding teeth, at the back.

The upper cuspids are often wrongly called eyeteeth and the lower cuspids stomach teeth. There is no special connection between these teeth and the eye and stomach.

Temporary and permanent teeth. Every person normally has two distinct sets of teeth. The first set is used during the first six



Courtesy American Dental Assn.

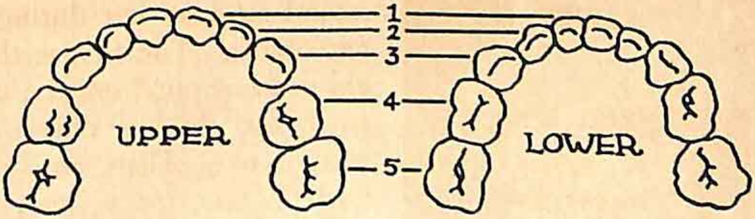
IN THE TEETH of a six-year-old child, the first or deciduous set is in place with the permanent teeth forming beneath them. Compare this picture with the X-ray photograph on page 81.

to twelve years of life, and the second set may last during the rest of life. The first teeth begin to grow out from the gums when the child is only a few months old. There are twenty teeth in this first or temporary set, and the last of them generally appear by the end of the second year of life.

These first teeth begin to loosen and fall out when a child is about six years old, but some of them remain until he is twelve or more years old. Underneath the temporary teeth, the permanent teeth are already forming. As the first teeth drop out, those of the second set push through the gums to take their places. There are thirty-two permanent teeth. The last molars, the four wisdom teeth, may not appear until sometime between the ages of seventeen and twenty-five years, or later, or not at all.

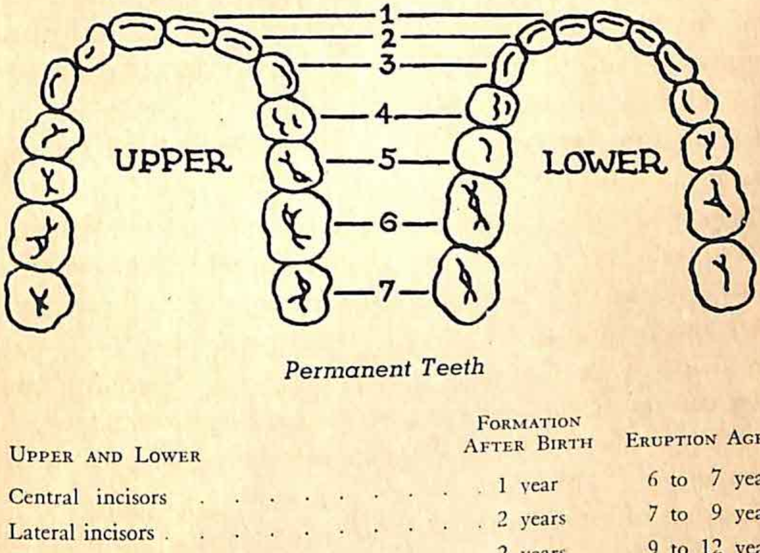
The first of the permanent teeth to develop are the first molars, called six-year molars because of the time at which they commonly appear. These first or six-year molars appear behind the baby molars and before the baby molars are lost. They are especially likely to decay prematurely. If they are not cared for and are lost by disease or extraction, the rest of the teeth are more likely to develop in abnormal positions, giving the whole jaw an irregular shape.

The parts of a tooth. Each tooth has one or more roots which secure it in a socket. The crown is the part visible above the gums and is protected by a layer of enamel, the hardest substance in the body. The root of the tooth is covered by cement, which serves to hold the tooth securely in place. The main body of the tooth is dentine. In the center of the tooth is the pulp cavity containing nerves and blood vessels. Teeth are kept alive by these blood



Temporary Teeth

Upper and Lower	Formation Before Birth	Eruption Age
1. Central incisors (front teeth)	5 months	6 to 9 months
2. Lateral incisors	4 months	8 to 12 months
3. Cuspids (eyeteeth)	4 months	16 to 20 months
4. First molars (back teeth)	4 months	10 to 20 months
5. Second molars (back teeth)	4 months	26 to 30 months

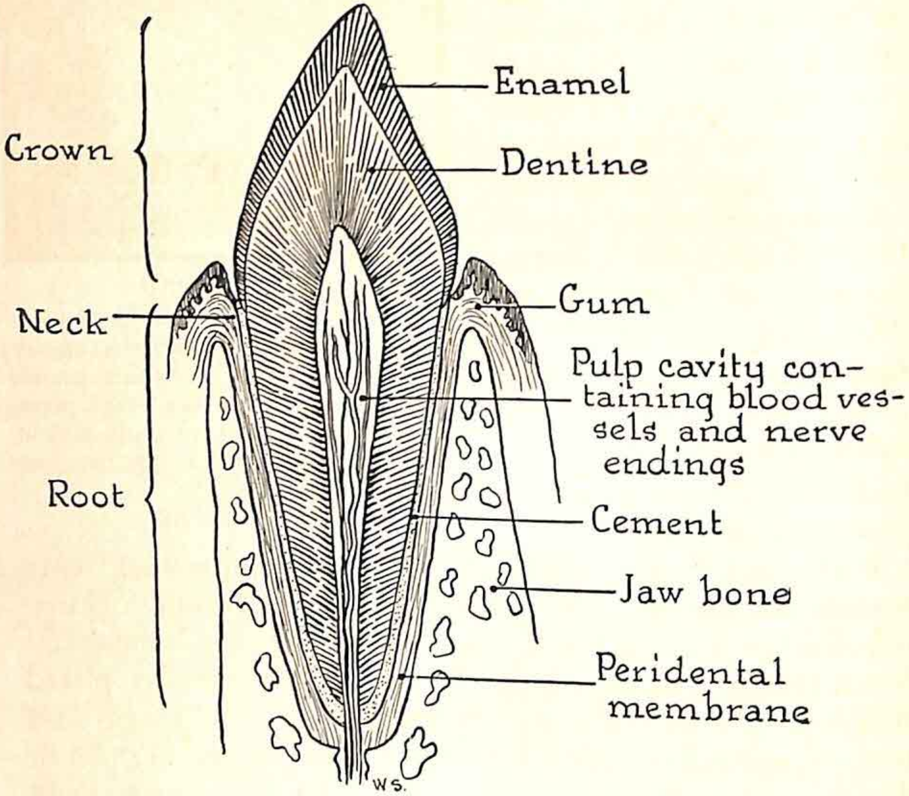


Permanent Teeth

Upper and Lower	Formation After Birth	Eruption Age
1. Central incisors	1 year	6 to 7 years
2. Lateral incisors	2 years	7 to 9 years
3. Cuspids	2 years	9 to 12 years
4. First bicuspids	5 years	10 to 14 years
5. Second bicuspids	5 years	11 to 12 years
6. First molars (six years)	At birth	5 to 6 years
7. Second molars	6 years	12 to 14 years
Third molars (wisdom)	9 years	16 and after

Courtesy *Hygeia*

vessels, unless the nerve is killed by disease or intentionally by a dentist. If the nerve in a tooth dies, the tooth is considered dead. The blood vessels that nourish the tooth are destroyed, and the tooth is liable to require extraction sooner or later.

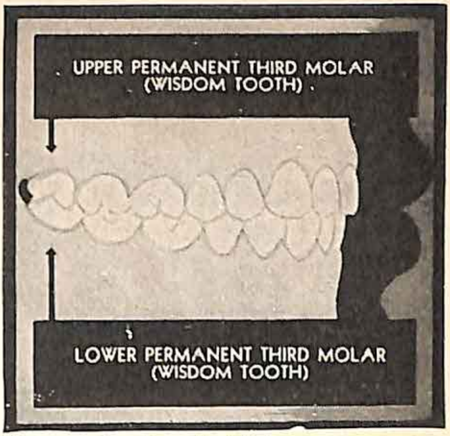


THE CANINE TOOTH is composed mostly of dentine, in the center of which is the pulp cavity containing nerves and blood vessels.

If a permanent tooth is injured or destroyed, it does not become replaced as are many other tissues of the body. It is thus important that the teeth be preserved as long as possible.

Maintaining sound teeth. An adequate diet is important in producing sound teeth. The quality of tooth substance is determined in part before the child is born. The diet of the mother before the child's birth and that of the growing child should contain foods rich in mineral salts and vitamins. Milk, eggs, fruits, green vegetables, and whole cereals help to supply these.

The teeth and the tissues that support them are thought to develop best through use. The diet should include food that requires vigorous chewing. On the other hand, we must not forget that the teeth will be permanently injured by biting hard objects, such as nutshells or brittle candy. The chief purpose of the teeth is to grind the food so that it can be mixed with saliva. Chewing or masticating food is the first step in the process of digestion.


UPPER PERMANENT THIRD MOLAR (WISDOM TOOTH)
LOWER PERMANENT THIRD MOLAR (WISDOM TOOTH)

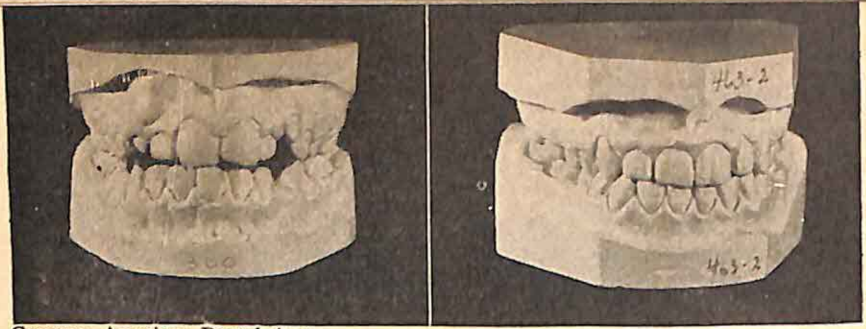
Courtesy American Dental Assn.

THE THIRD permanent molars (wisdom teeth) should erupt between the seventeenth and twenty-first years. Sometimes they do not erupt properly, becoming impacted or locked beneath the second permanent molars.

If the teeth in the upper and lower jaws oppose each other accurately in the acts of biting and chewing, the occlusion (meeting of the teeth) is said to be good. Proper occlusion is important for a healthy condition of the teeth. If the teeth are placed properly, they are kept clean by friction with the cheeks and tongue, provided there is considerable coarse material in the diet. A person with irregular teeth needs to be especially careful about cleaning the teeth and the gums.

Permanent teeth that grow out irregularly should be straightened, if possible. Thumb-sucking in infancy may interfere with the position of the teeth. Adenoids and enlarged tonsils result in mouth-breathing and may cause deformity of the bony framework of the jaws and palate, as well as irregularly placed teeth. Such teeth are hard to clean, and lose some of their efficiency for chewing. They are also more likely to decay early. Poor digestion, defective speech, and unnatural facial expression often result from such defects in the jaws and teeth.

Teeth that are irregular may be straightened by the dentist,



Courtesy American Dental Assn.

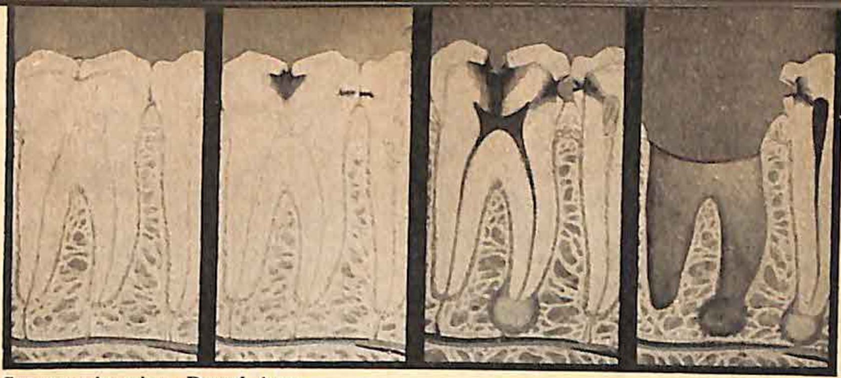
THESE CASTS show the same set of teeth before and after they were straightened.

with braces or wires that gradually pull the teeth into position. Necessarily this is a slow and expensive process. But such slow adjustments often make great improvement in personal appearance and in general health because of the better utilization of food.

Unsound teeth. Examination of school children shows that defects appear early. People often do not realize the need of dental care of baby teeth. If any are lost jaws may not develop so that there is space for permanent teeth. It is estimated that the average sixteen-year-old in the United States has seven fillings and two extractions. Other defects besides dental caries (decay) are malocclusion, insufficient number of teeth, deformities of the mouth, and diseases of the gums.

Apart from injuries, there are two conditions that may result in loss of teeth. One causes decay of the tooth itself, and the other destroys the gums and bone that support the teeth.

The causes of teeth decay are not well understood. At different times, the tendency to decay has been blamed upon excessive sugar in the diet, carelessness as to proper chewing of food, and a number of other causes. In some apparently healthy people the teeth decay rapidly in spite of regular cleaning with a toothbrush. However, it can hardly be doubted that carelessness in leaving particles of food on the teeth is likely to lead to bacterial action which will gradually cause decay in the enamel or cement. One favorite belief as to the formation of cavities is to the effect that groups of lactic acid bacteria collect on the teeth and that the acid produced by these bacteria gradually eats into the surface of the enamel. After the enamel dissolves, bacteria enter the tooth and decay results.

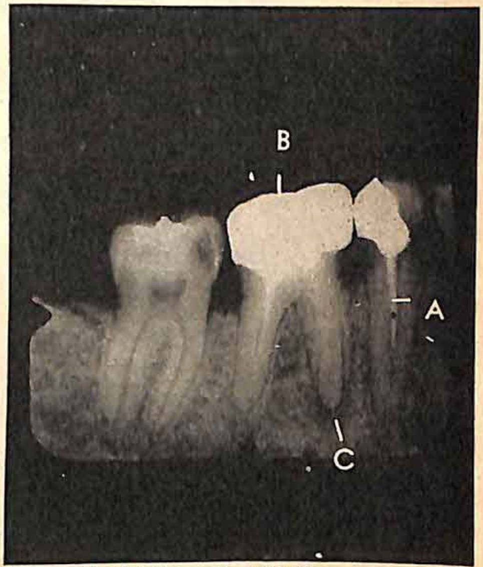


Courtesy American Dental Assn.

HOW TOOTH DECAY begins and continues is shown in these pictures. *From left to right*: The presence of food in a defective groove and between the teeth causes the beginning of decay; next the decay penetrates the enamel and attacks the dentine; then the decay kills the molar pulp, causing an abscess to form (in this case the bicuspid pulp is also infected). In the last picture the abscessed molar has been extracted and the bicuspid has abscessed.

Some experts believe that one important cause of decay is internal rather than external, in other words, that the decay is due to something wrong with the general system of the individual rather than to special changes developed in the mouth.

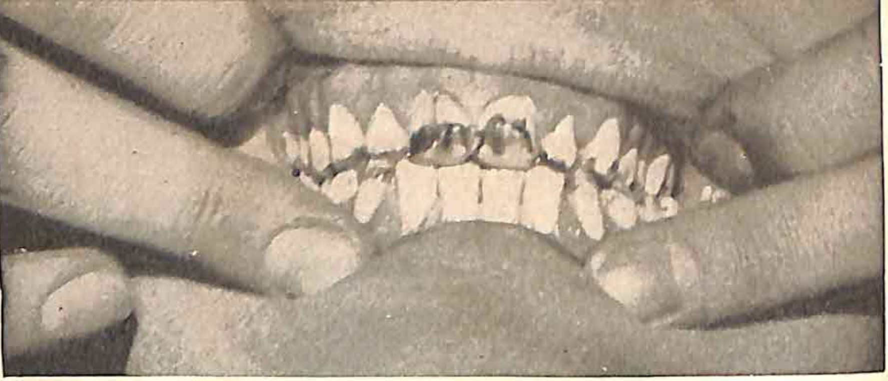
At present there is no definite answer concerning the effect of conditions within the mouth upon the decay of teeth. Probably of greatest importance are tooth structure due to heredity and the mineral and vitamin content of the diet.



Courtesy Ira C. Brownlie, D.D.S.

IN THIS X-RAY photograph, *A* shows a bicuspid with a filled root canal; *B* is a molar with an artificial crown; and *C* indicates an abscess forming at the base of a root.

Fluorine and tooth decay. For many years it has been observed in areas supplied with drinking water containing fluorides that the teeth of the children



Courtesy F. S. McKay, D.D.S., Colorado Springs

THESE TEETH became permanently mottled and discolored because the drinking water contained more that 1.8 parts per million of fluorine.

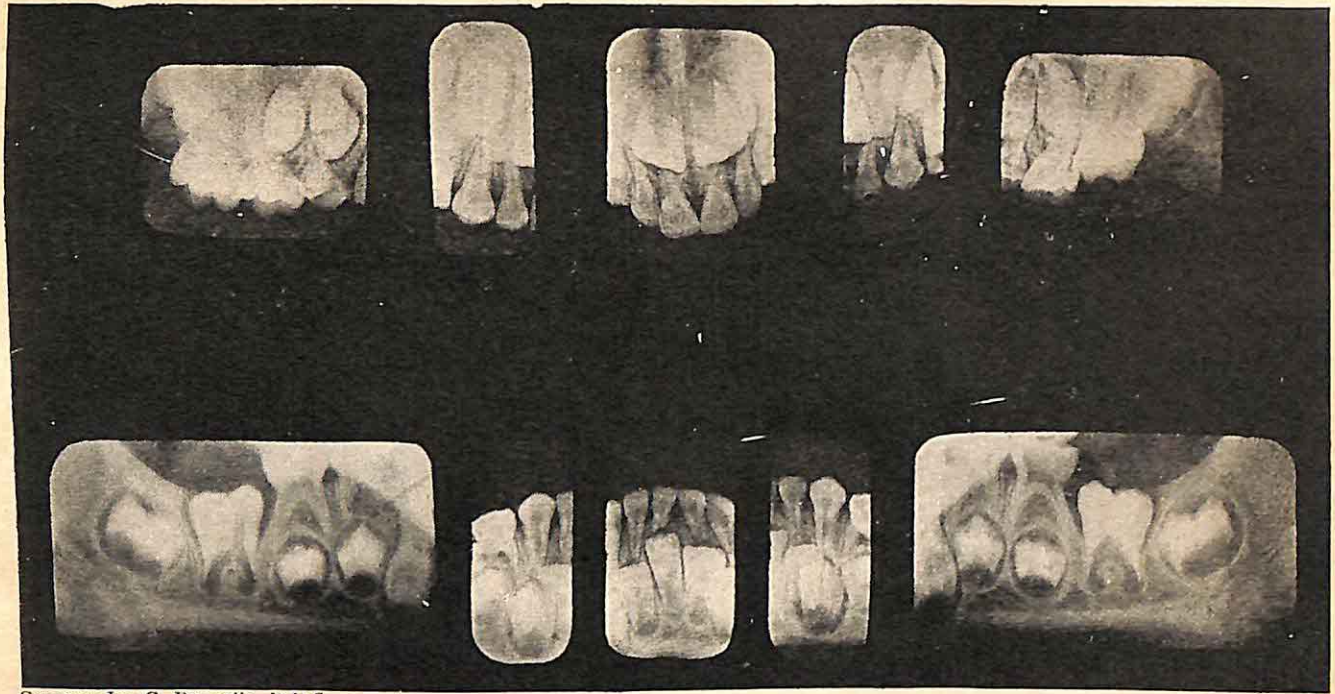
are mottled and discolored. In mild cases the enamel has opaque white spots; in more advanced cases it becomes rough and pitted. In severe cases the discoloration varies from tan to brown or black. This condition, known as *fluorosis,* develops in the teeth only while they are being formed, and it does not occur where the drinking water is free from fluorine.

It has, however, been found that fluorine is an essential mineral in healthy tooth development. In the children of localities where the fluorine content of water is about one part to a million parts of water, surveys have shown that tooth decay is less common than where fluorine is less prevalent or lacking. When water contains over 1.8 parts per million, the teeth tend to show mottling or discoloration. An excessive amount of fluorine may be removed from water by adding such chemicals as magnesium oxide.

Tartar. Tartar is composed of salts deposited on teeth, where it gradually hardens. It may be derived from saliva and food wastes, but its origin is not thoroughly understood. For about twelve hours the deposits remain soft enough to be removed by a brush. Later they become so hard that steel instruments are necessary for their removal.

The tartar irritates the gums by creating tiny lesions which bacteria may enter and by causing the gums to become red and swollen. The circulation of the blood may be interfered with so that the gums are not properly nourished.

Diseases of the gums. *Pyorrhea* is a disease of the gums and bone around the buried parts of the teeth. More teeth are lost



Courtesy Ira C. Brownlie, D.D.S.

THESE X RAYS of the upper and lower jaws of a child six years of age show twenty temporary teeth. Beneath these teeth lie a second group of teeth, the permanent set. As the permanent teeth grow, they push the temporary teeth ahead of them. Twenty-eight permanent teeth are visible. At this age the third molars (wisdom teeth) are not in evidence. Can you locate the six-year molars and the second molars?

because of this disease than because of cavities from decay. In pyorrhea the tissues around the teeth are broken down through the action of bacteria, pus forms, and the teeth frequently become loose. The poisons from the pus may be carried by the blood to other parts of the body. This condition may have a profound effect on general health. Proper dental care may retard or prevent the development of pyorrhea.

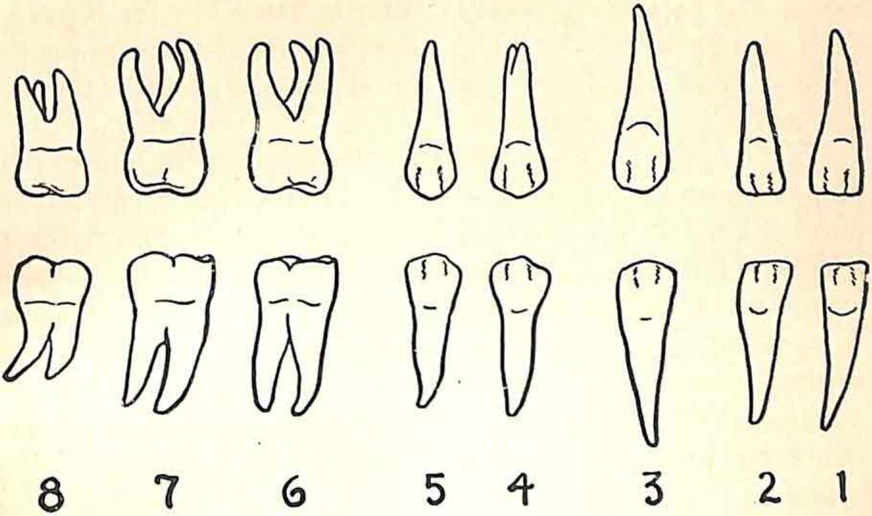
Trench mouth. This very contagious disease of the gums came into prominence during World War I. Well-known agents of transmission are common drinking cups, public eating places, telephone mouthpieces, common towels and toothbrushes, cigars, cigarettes, candies, pencils, and any article that may carry saliva from mouth to mouth. The disease may also be transmitted by kissing, by coughing, or even by speaking at close quarters. A mouthwash of sodium perborate, or other oxygen-liberating substance has been used in treating trench mouth; but this drug is said to be harmful if used too frequently, so the advice of a dentist or physician is always advisable.

Danger signals. Pyorrhea, decaying teeth, and improper digestion of food, as well as unhealthy nose and throat conditions, are causes of bad odor from the mouth. Normal gums are pink, dense, resist pressure, and have a flat edge. Bleeding gums should be a warning for you to consult your dentist. The poisons from a diseased mouth may cause serious disturbances in other parts of the body. It is a wise practice to visit a dentist at least twice a year for examination and care, and to have faulty conditions treated without delay.

Three minutes after meals. Strange as it may seem, few people know how to brush the teeth properly. Most persons take too little time and too little thought for this performance. As a result, the teeth are not cleaned nor is the gum tissue correctly stimulated.

The careful housewife spends much time washing thirty-two dishes, one by one—much more time than the average person does in brushing thirty-two teeth. Yet a tooth is much harder to clean than a dish.

Three times a day, after each meal, should be the minimum time spent in cleaning the teeth. When a meal is eaten away from home and it is not practicable to brush the teeth, the mouth should be rinsed with water. This should be done, also, whenever any candy is eaten. Brushing should clean all surfaces to help prevent decay and the formation of deposits. It should also stimulate the gums to make them resistant to mechanical injury and bacterial invasion.

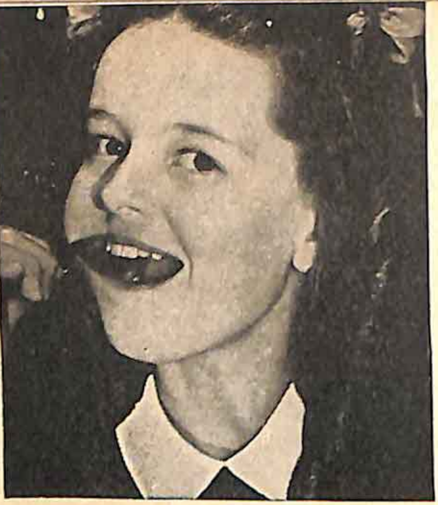


THE PERMANENT TEETH on the right side of the mouth, upper and lower jaws, are composed of *1*) the central incisors, *2*) the lateral incisors, *3*) the cuspids, *4* and *5*) the first and second bicuspids, *6* and *7*) the first and second molars, and *8*) the wisdom teeth.

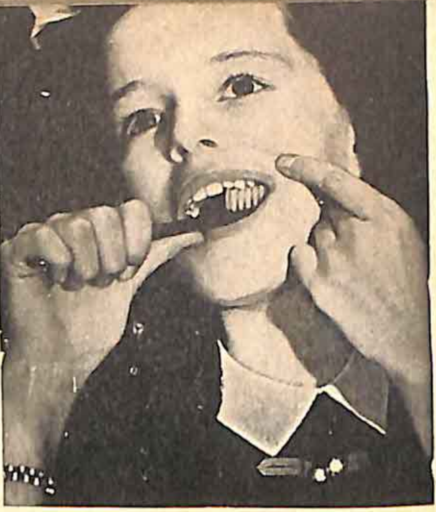
The toothbrush. Mouth examinations show that over 90 percent of adults have unhealthy gums. Neglect, past or present, as to the effective use of the toothbrush, may contribute to this condition.

To eliminate all bacteria from the mouth is impossible. The toothbrush should mechanically disturb the little lactic acid factories, so that the acid formed can be diluted or neutralized by the saliva. Vigorous use of the toothbrush will also lessen the amount of tartar formed and so minimize the damage to the gum tissue.

A small, fairly stiff-bristled brush is best. It should have about seven crossrows of bristles, with two or three tufts of bristles in



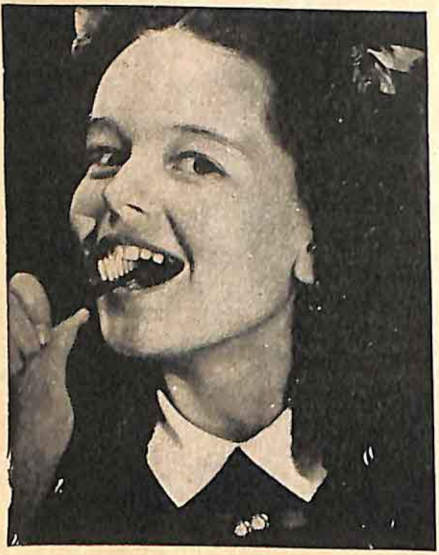
1. Clean the cheek surfaces of the back teeth. The bristles of the brush should rest on the upper last teeth and should point upward. Partly close the mouth and firmly roll the bristles down over the gums and teeth toward the grinding surfaces. Slowly work the brush forward to the front teeth. All movements for brushing the teeth should be repeated several times in each position.



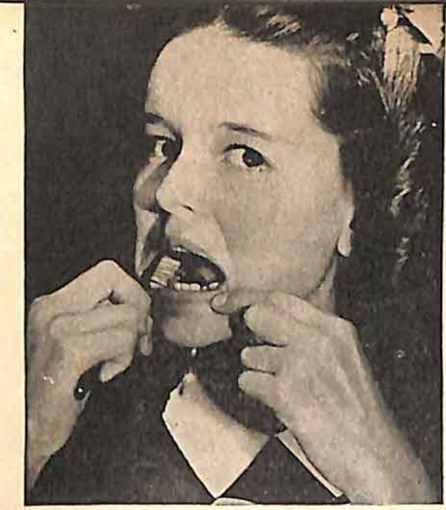
2. Clean the inside surfaces of the back teeth. Place the brush well back in the mouth between the tongue and the upper back teeth. The bristles of the brush should rest well up on the gums, over the upper last teeth, and they should point slightly upward. Bring the bristles of the brush down over the gums and necks of the teeth toward the grinding surface.

The Seven Steps in the Proper Brushing of the Teeth

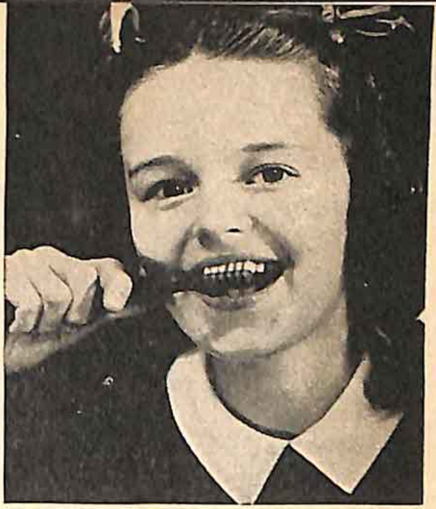
(All pictures by courtesy of the American Dental Assn.)



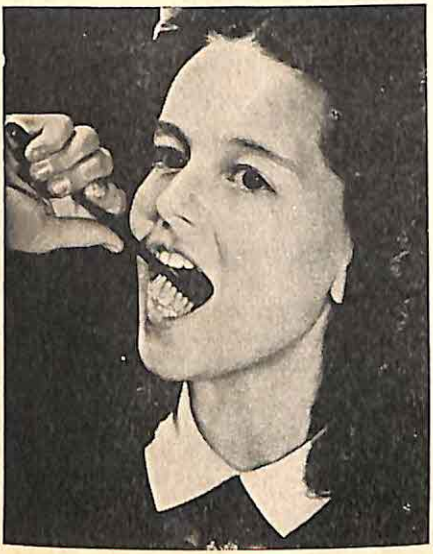
3. Clean the inside surfaces of the upper front teeth. In brushing the inside surfaces of the upper front teeth, place the bristles of the brush in the mouth lengthwise. The bristles should rest against the inside surfaces of the front teeth and the roof of the mouth. Draw the bristles downward and forward from the gums over the necks of the teeth toward the biting surfaces.



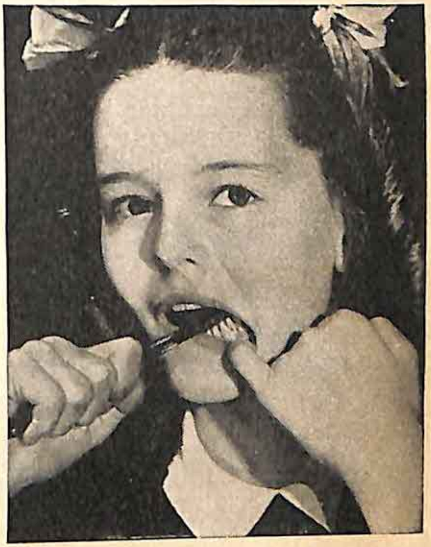
4. Clean the outside surfaces of the lower back teeth.



5. Clean the outside surfaces of the upper and lower front teeth.



6. *Clean the inside surfaces of the lower front teeth.* In brushing the inside surfaces of the lower front teeth, draw the bristles upward and forward. Note the position of the brush for proper brushing of the lower front teeth.



7. *Clean the grinding or biting surfaces.* Do not fail to brush the grinding or biting surfaces of the teeth. The broad, uneven surfaces of the teeth easily catch and hold particles of food. With a backward and forward motion, remove the bits of food that have been crushed into the grooves.

each row. The handle should be at least six inches long, so that it can be grasped firmly.

Keeping the teeth clean. In using the brush, place the bristles against the teeth with sufficient pressure to force them into the spaces between the teeth without pricking the gums. Use a slight wiggling or vibratory movement with pressure only on the upward stroke for the lower gums and teeth and only on the downward stroke for the upper gums and teeth. Brush the inner surface of the lower teeth first. This is where the greatest amount of saliva empties into the mouth and where tartar is apt to form first. The chewing surfaces of the teeth may be brushed in any direction.

A new brush should be placed in a strong, cold, salt solution for two hours before using. This will set and clean the bristles and take away the original hardness. Tepid water should be used to moisten the brush for brushing and to rinse it after brushing. Very warm water should never be used. A brush should be allowed to dry for twenty-four hours after using, so that the bristles will regain the original and necessary stiffness. It is well to have two brushes, one for morning use and one for evening use, so that a dry brush is always available. The brushes should be replaced before they become too badly worn.

When contact points are faulty so that food cannot be dislodged from between the teeth with a brush, dental floss (a fine silk tape) should be used to remove particles. Draw the floss gently back and forth between the teeth. One should be careful, however, not to cause bleeding of the gums by its use.

Dentifrices and mouthwashes. The purpose of a dentifrice is to aid in mechanical cleansing of the teeth without injury to them. Mild abrasives are employed, the safest and most universally used being precipitated chalk. Soap is added because of its supposed cleaning effect, but to many gums it may act as an irritant. Soapy dentifrices are a decided handicap because of the softening effect soap has on the bristles of the brush, especially when used with warm water.

As soon as acid was thought to be associated with the process of decay, dentifrices containing various kinds of alkaline substances were introduced, with the idea of neutralizing the lactic acid and thus making it harmless. There is, however, no clear proof that any chemical is more effective than merely keeping the teeth thoroughly clean.

Mouthwashes are used to eliminate mechanically, by vigorous rinsing, all the food and other particles that have been loosened by the brush. Plain warm water, a salt solution made by adding one-half teaspoon of salt to a glass of water, and the same solution with a little baking soda (sodium bicarbonate) added, are the three safest and cheapest mouthwashes.

The value of toothpastes, tooth powders, and mouthwashes is greatly overestimated. The cool, clean feeling left by a highly-flavored mouthwash may only disguise a dirty mouth. Dentifrices have very little use. Because they are pleasantly flavored, they make the brushing of teeth a more agreeable task. So far as care of the teeth is concerned, it would be wiser to put more money into toothbrushes and nothing into toothpastes and mouthwashes.

In conclusion

IT TAKES approximately eighteen years to produce the teeth which are to serve a lifetime. It is therefore important that, in order to build and maintain sound teeth, each person shall have the right kind of food while the teeth are forming, and shall then use his teeth correctly and keep them as clean as possible.

Activities

1. Examine your teeth. While facing a good light, open your mouth wide and hold a mirror so that you can see into the mouth. Count the number of teeth in each of the following groups: a) incisors, broad cutting teeth in front; b) canines, pointed teeth next to the incisors; c) premolars, grinders with two points on the biting surface; and d) molars, teeth with more than two points, in the back of the mouth. What is the condition of your sixth-year molar? What teeth of the second set do not appear in your mouth?

2. Cut a model of a tooth from a piece of hard soap.

3. Illustrate the action of an acid on the teeth by putting hydrochloric acid on an eggshell. Note how rapidly the shell dissolves.

Test

Directions: There are five incomplete statements in this test (A, B, C, D, and E), each followed by the same number of parts. One part best completes the incomplete statement, and the other parts are either true or false. On a separate sheet of paper copy the five letters and the numbers of their parts in a vertical column. Place a plus sign (+) after the number corresponding to each true answer, and a small zero (0) for each false answer. Do not write in the book.

A. Tooth decay depends upon
   1. the action of bacteria.
   2. excessive use of sugar.
   3. the action of an acid on the enamel.
   4. poor chewing of the food.
   5. conditions existing elsewhere in the body.

B. The care of the teeth is important
   1. because bacteria will eat the teeth if they are not kept clean.
   2. because proper mastication depends upon sound teeth.
   3. because food particles between the teeth decay, forming an acid.
   4. because the enamel is kept smooth, which prevents places for bacteria to lodge.
   5. because beautiful teeth improve one's smile.

C. Sound permanent teeth require
   1. proper attention to the care of the temporary set.
   2. that the grinding surfaces meet correctly.
   3. cleaning thoroughly at least twice a day.
   4. the use of a mouthwash daily.
   5. food containing calcium, phosphorus, and vitamins during their formation.

D. Tooth powders
   1. always prevent decay of teeth.
   2. aid in the cleaning of teeth.
   3. stimulate the gums.
   4. may contain substances to which some people are sensitive
   5. polish the enamel.

E. Correct brushing of the teeth should
   1. remove all particles of food.
   2. lessen the amount of tartar formed.
   3. stimulate the circulation of blood in the gums.

4. whiten the teeth.
5. remove the film.

Associated subjects

Biology: The importance of the teeth in the digestion of food. . . . The structure, use, and care of the teeth. . . . Possible diseases of the gums.

Chemistry: The chemical nature of acid and alkaline substances and of calcium compounds.

Home economics: The choice of foods, the basis of one's eating and chewing habits. . . . The part of well-kept and well-formed teeth in improving one's personal appearance.

Physics: The cutting and grinding effects of opposing surfaces.

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8. *VOICE AND FACE REFLECT THE PERSONALITY*

A SMILING face with a kindly expression is attractive, even though the features may be irregular. Frowning too frequently makes the face appear sullen.

The voice often makes a lasting impression on the hearer. The tone of voice, its pitch and inflection, the rapidity and ease with which one speaks—these things stamp one as an individual different from others.

Do you know . . .

1. How the face impresses others?
2. How facial expression may be changed?
3. Where the voice originates?
4. How one can cultivate a pleasing voice?
5. If it is possible to speak without using the vocal cords?
6. Why the voice of a growing boy changes?
7. In what ways speech may be affected?
8. How breathing through the mouth tends to deform the face?
9. Why some people are mouth-breathers?
10. How we breathe?
11. Why respiration is an important life process?
12. What prevents water and food from going into the windpipe when we swallow?
13. How air enters the lungs?
14. What a sore throat is?
15. What sinus trouble is?
16. What causes coughing?
17. How a well-developed chest helps in singing or in athletics?
18. What changes the quality of the voice?
19. How to cultivate good articulation?
20. How adenoids may interfere with breathing?
21. How bacteria can enter the sinuses?
22. How the diaphragm moves in breathing?
23. How air is modified as it passes through the nose?
24. Where the voice box is located?
25. How to prepare an inexpensive gargle?

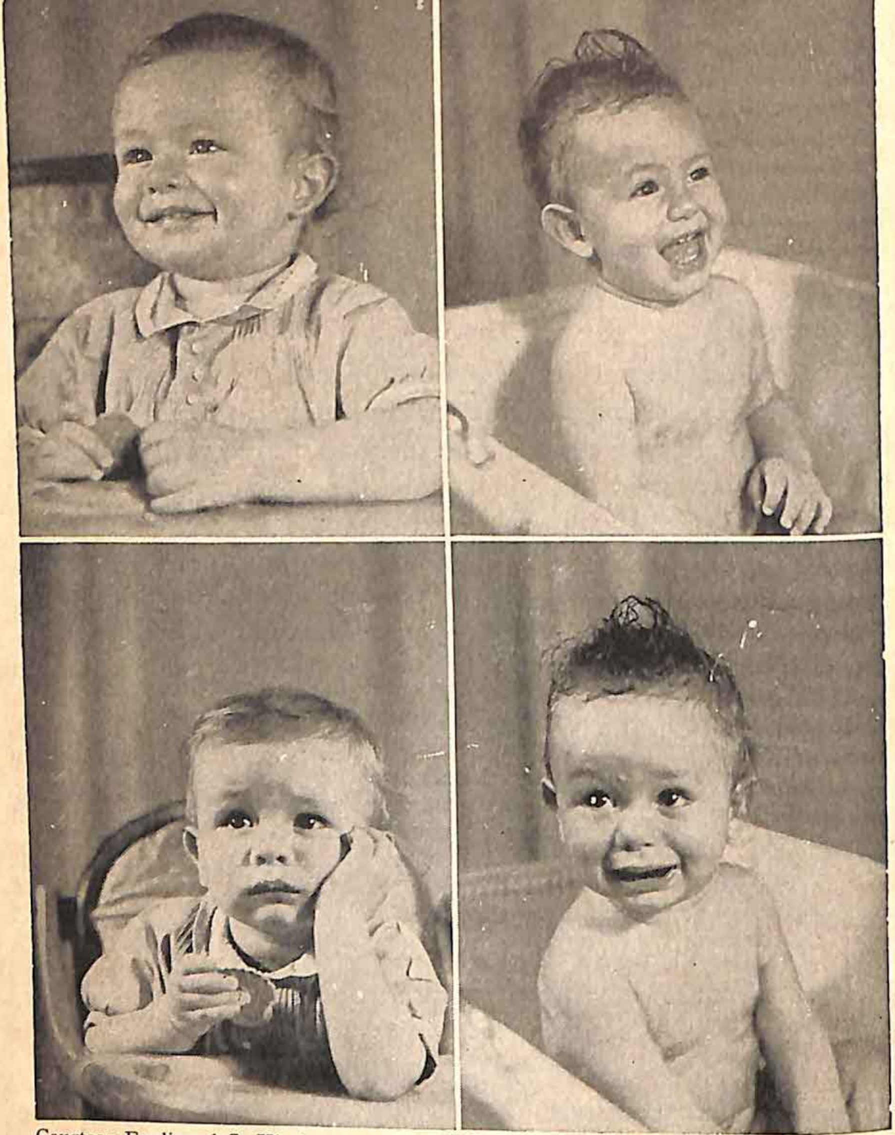
The telltale face. Man is one of the few animals whose faces can show different emotions. Monkeys can look sad, but they do not smile. Dogs and cats can only show anger, and not pleasure, through facial expression. The emotions expressed in the human face give others an insight into the character of the person. A pleasing personality expresses itself in a face that can smile and that looks happy.

In normal children the face is a mirror of the emotions. Changes in expression are due to the automatic action of facial muscles that register certain emotions. As children grow older, they learn to control these facial muscles. Actors must develop such expert control of these muscles that they can express any emotion at will. Any person exhibits voluntary control of facial muscles when he suppresses the impulse to laugh.

The human face is flat compared with that of other animals. Some faces with protruding chins may have a bull-dog expression, while others with very little lower jaw may resemble Andy Gump of the comic strip. Hence a false notion has been built up about the chin as an index of character. There is no reason for believing that the two have any relation to each other.

The voice we hear. The quality of one's voice is an important influence in getting along with others. A voice that is monotonous is uninteresting; one that is shrill and high-pitched is irritating. Failure to use the nasal passages correctly in speaking may be the reason. A pleasing voice is resonant and under control so that it may be loud or soft, varying with the need of the moment. A well-modulated tone and careful articulation of words indicate good training in speech.

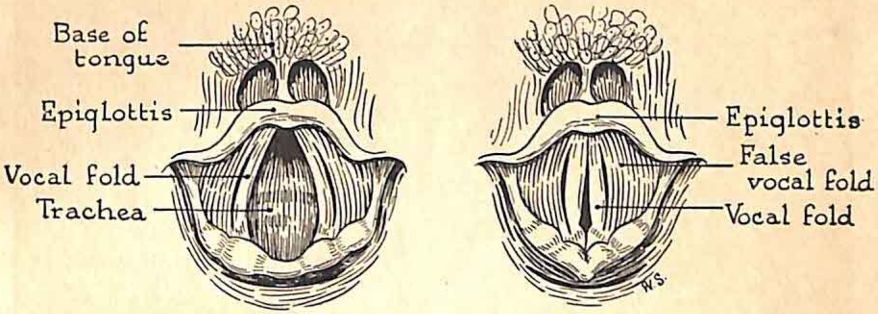
The vocal cords. The voice box or larynx is a small chamber with stiff walls of cartilage. At the top it opens into the throat (pharynx), and it is continuous with the windpipe (trachea) below. The upper part of the voice box forms the projection in front of the neck often called Adam's apple. Inside the voice box is a pair of straight, elastic bands called the vocal cords. These vibrate in unison when air is forced between them, and so produce the pitch of the voice. During breathing the vocal cords are quite far apart; in speaking they are drawn nearer together. A



Courtesy Ferdinand S. Hirsh

NOTICE HOW the expression of the baby's face changes from happiness in the top pictures to sorrowful dismay in the bottom photographs. Your expression is altered just as greatly when you wrinkle your forehead or draw down the corners of your mouth. Such changes of expression are brought about by the movement of the facial muscles. In this way various emotions are revealed in the face. The same emotional reaction repeated many times may have a permanent effect upon the face. It is better, therefore, to try to suppress disagreeable feelings that arise and to cultivate desirable ones.

low pitch of the voice is produced by slow vibration of the cords when they are relaxed and farther apart, and a high pitch, by more rapid vibrations as the cords become tense and are pulled close together. Loudness and volume depend on the speed and amount of air passing through the vocal cords.



THE INTERIOR of the larynx, when viewed from above during normal breathing, looks something like these drawings. *Left*, with vocal folds separated. *Right*, during singing, with vocal folds brought together. Air, when forced up through the slitlike opening, makes the margins of the slit vibrate and produce voice.

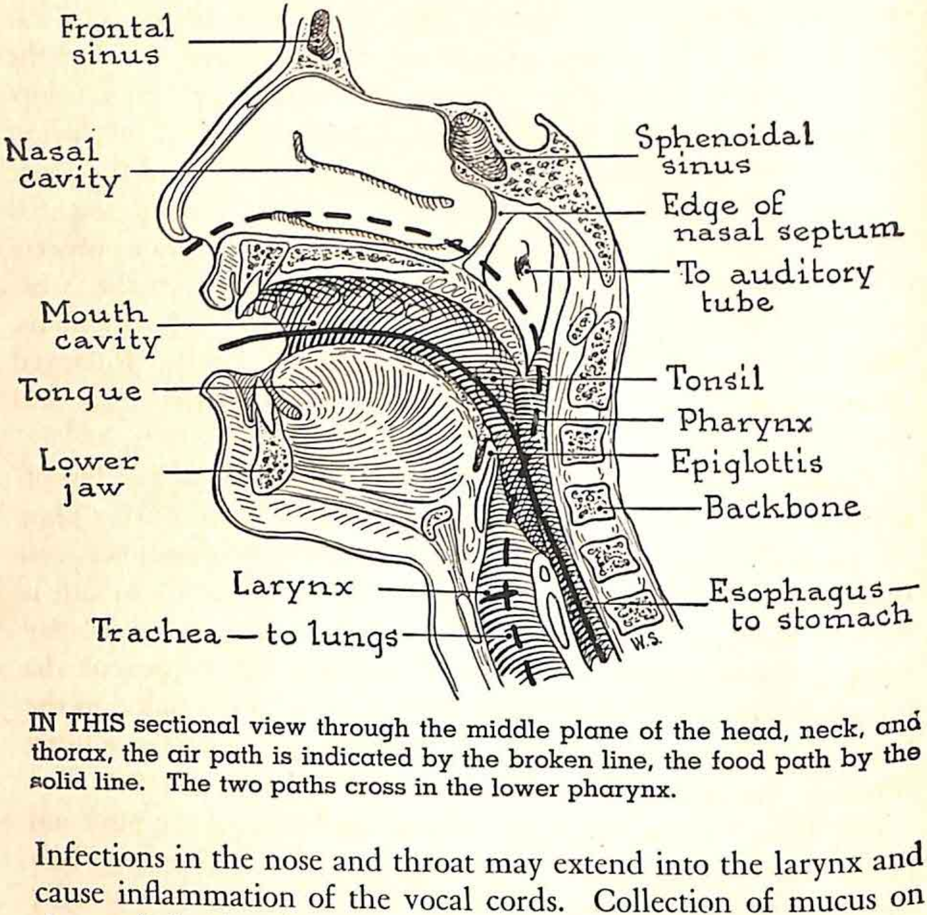
Whispering is speech without voice. The vocal cords do not vibrate, and sound is produced by the partial cutting off of the air by the lips, tongue, teeth, or soft palate.

Why voices differ. Men have deeper voices than women because their voice boxes are larger and their vocal cords are longer. When a boy's voice box begins to grow in size, his voice is likely to break, for it is changing from the high, clear voice of the boy to the deep, heavy voice of the man. In fear and in excitement the muscles in the throat often contract, increasing the tension of the vocal cords, and a high, squeaky voice results.

The quality of the voice is modified by the mouth and nose cavities. The action of the lips, teeth, tongue, and palate shapes the many letter sounds of language (phonetics). Good articulation depends on correct use of these parts in forming words. Enunciation is much improved by free action of the muscles which move the lips.

A resonant voice requires lungs that can hold a large amount of air, and chest muscles that can regulate the movement of the air. The air should be directed partly toward the roof of the mouth, partly through the nose.

How the voice is affected. Any inflammation or obstruction of the air passages may produce an unpleasant and abnormal voice.



IN THIS sectional view through the middle plane of the head, neck, and thorax, the air path is indicated by the broken line, the food path by the solid line. The two paths cross in the lower pharynx.

Infections in the nose and throat may extend into the larynx and cause inflammation of the vocal cords. Collection of mucus on the cords in the pharynx may result in hoarseness.

Sometimes the partition between the right and left nostril is bent to one side, filling up the space and preventing breathing on that side. Other nasal deformities may produce a similar effect.

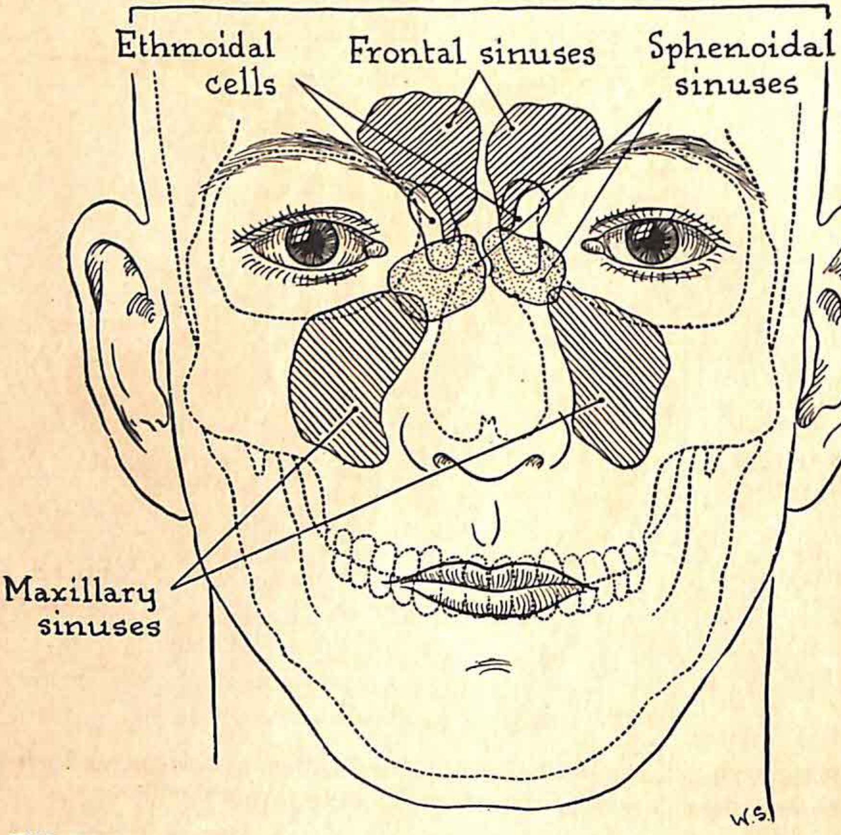
Stammering may be due to structural defects, but more often it arises from a weakened nervous condition or emotional disturbance. Learning to speak slowly and distinctly and breathing correctly will help in correcting speech difficulties.

Adenoids. On the roof of the throat, just back of the nasal passages, are spongy masses of lymph node tissue called adenoids. Normally they should cause no obstruction and should shrink as children grow older. In some children they become enlarged so as to obstruct the passage of air from the nose to the throat, and inflammation of adenoids may cause sore throat and ear trouble. In order to get enough air, such children develop the habit of mouth-breathing. This interferes with proper development of the bones of the nose, cheeks, and jaw, often producing a dull facial expression. The tongue becomes dry, and the sense of taste is affected. Body resistance may be greatly lowered through loss of appetite and sleep. Because the air is not properly warmed or cooled, moistened, and cleaned, and sometimes because of throat infection which frequently exists in the adenoids, the affected individual is more susceptible to colds. Enlarged adenoids are a serious handicap to the health of the child and should be removed.

Tonsils. Tonsils, like adenoids, are largely composed of lymph node tissue which produces white corpuscles (see p. 220). They are located on each side of the throat, back of the mouth between the muscles of the soft palate, and are visible when the mouth is opened widely. When diseased or greatly enlarged, tonsils may cause much trouble. They should be removed to prevent the poisons produced in them from being carried by the blood to the heart and other organs of the body. Such poisons may cause heart ailments and rheumatism or "growing pains" (see p. 210).

Hay fever. In some people the mucous lining of the nose and throat is very sensitive to foreign substances, such as animal hair and the pollens of certain flowers. These pollens are usually abundant in the air in late spring, summer, and early fall. Susceptible people inhaling them get hay fever. Skin tests are made to determine which pollens or foreign substances cause the poisoning. Vaccinations, or hypodermic injections of preparations containing the specific pollen or disturbing agent, may give more or less complete relief.

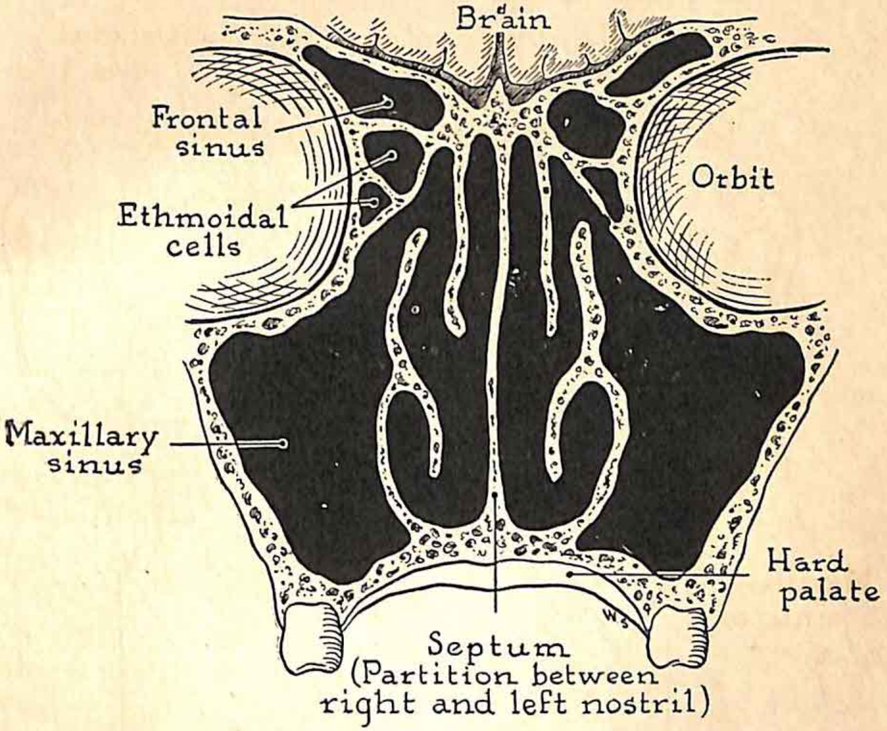
Why the body needs air. Oxygen is necessary for the burning or oxidation of food in the cells of the body. It is supplied in the air we breathe. The burning of food material produces heat and energy to do work. Carbon dioxide is formed as a waste product that is given off through the lungs.



THE SINUSES communicate with the nasal cavities and so are subject to infection through the nose.

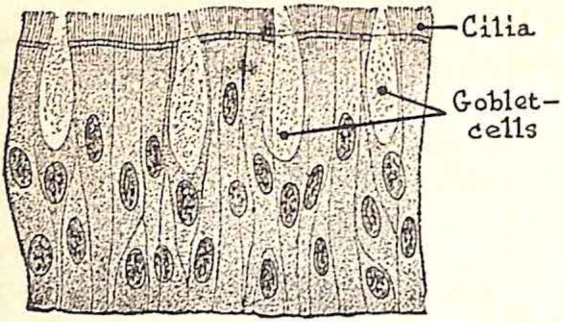
After air enters the nose, it passes through the throat and down the windpipe into the two lung tubes (bronchi). These tubes branch into smaller and smaller tubes until the whole lung is penetrated by a network of fine tubes resembling the branching of a tree. At the ends of the smallest tubes are air sacs which are surrounded by tiny blood vessels (capillaries). In these air sacs the interchange of gases takes place. Oxygen from the air passes into the blood through the capillary walls, and carbon dioxide gas is given off by the blood to the air sac. The red corpuscles of the blood carry the oxygen to the cells of the body.

Where the air should enter. The nose is well adapted for breathing. A mucous membrane which is extremely well supplied with blood lines the entire cavity of the nose. The blood warms the air, and the mucus secreted by the membrane moistens the air. Hairs lining the front part of the nose act as filters to remove dust and dirt from the air before it goes on toward the lungs.



A TRANSVERSE vertical section of the mouth, nasal cavities, and eyes shows how the sinuses (air spaces) surround the nasal cavities.

Sinuses. In the bones of the head surrounding the nose are air spaces, called *sinuses,* which connect with the interior of the nose. One (maxillary sinus or antrum) lies in each side of the upper jaw below the eye socket. Another (frontal sinus) lies behind each eyebrow. There are other sinuses: the ethmoid, between the eyes, and the sphenoid, between the ears and beneath the base of the skull. These air spaces are lined with mucous membrane which is continuous with the membrane lining the nasal cavities.



CILIATED CELLS line the windpipe. The goblet-shaped cells are filled with mucus which keeps the walls moist.

Inflammation or infection of these sinus membranes is called *sinusitis* ("sinus trouble"). Sometimes, while blowing the nose during colds and other nose and throat diseases, the air—laden with bacteria—may be forced into the sinuses and the Eustachian tubes (see p. 132). To prevent compression of the air while blowing the nose, close only one side at a time, leaving the other side wide open, and then blow gently. No pressure should be exerted below the bony half of the nose. There is still less danger of compression if both nostrils are kept open.

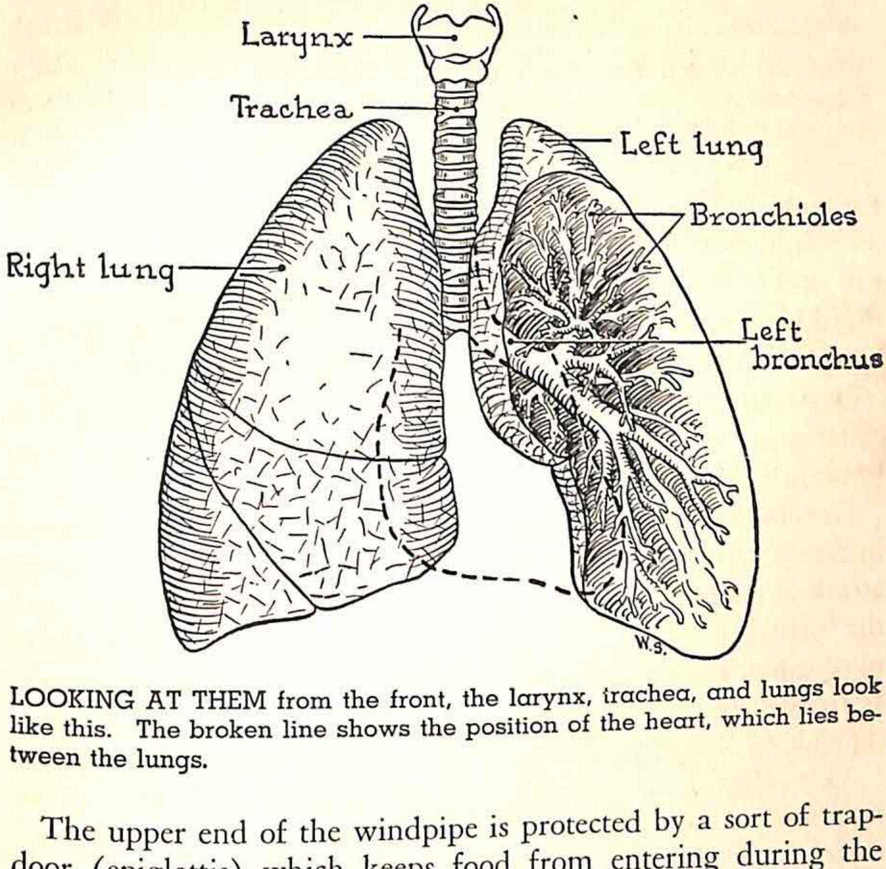
Bacterial infection from decayed and abscessed teeth may also cause sinus infection. Pus and poisons from infected sinuses may be absorbed into other parts of the body.

Generally sinusitis disappears after a short time, but a chronic infection may occur which needs medical attention. An acute attack of sinusitis is accompanied by headache, fever, fatigue, and the formation of pus. Unless treated by a physician, this is likely to continue to cause pain and to lower resistance to other diseases. It frequently follows or accompanies a severe cold. It is often difficult to treat and in some cases requires a surgical operation.

Very often a sore throat develops with a cold. This in an inflammation of the mucous membrane lining the nose and throat. Gargles give temporary relief because of the cleansing effect and the action on the circulation of blood in the tiny blood vessels. An inexpensive gargle can be made by dissolving one-fourth teaspoonful each of table salt and baking soda in half a glass of warm water. When used quite warm, this is as effective as more expensive preparations used as gargles.

The windpipe, a passageway. The windpipe is located in front of the food canal and is kept open by U-shaped rings of cartilage.

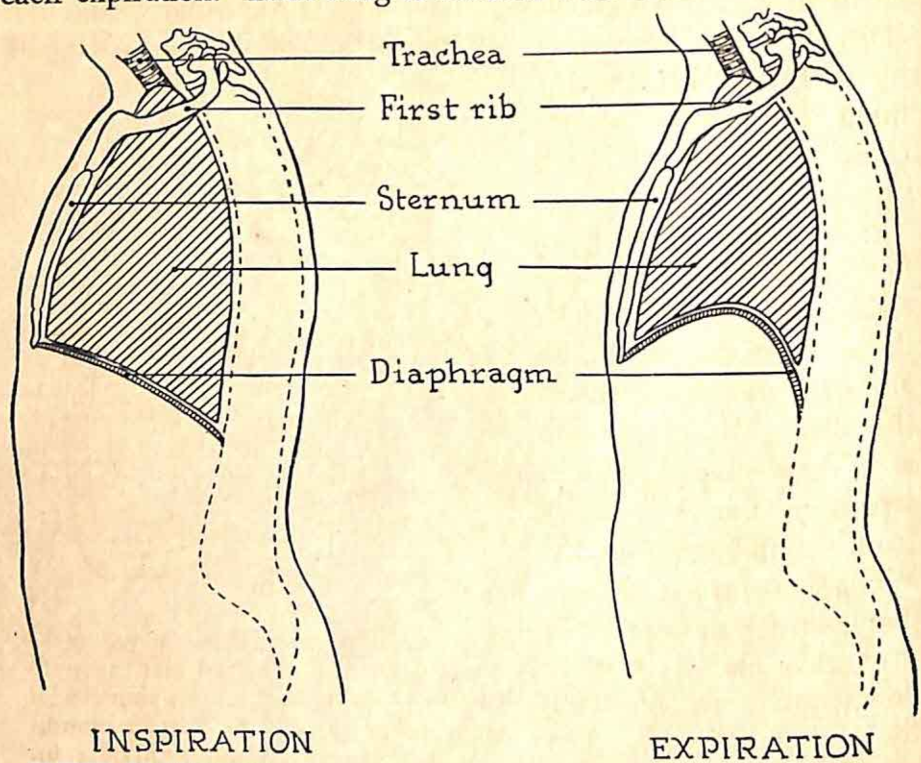
The rings below the voice box can be felt in the lower part of the front of the neck. The mucous lining bears on its surface minute hairlike processes called *cilia* that are in constant motion, like a field of wheat in a breeze. By this motion, the mucus—carrying dust and germs—is driven up into the throat, whence it is forcibly expelled from the air passage by coughing.



LOOKING AT THEM from the front, the larynx, trachea, and lungs look like this. The broken line shows the position of the heart, which lies between the lungs.

The upper end of the windpipe is protected by a sort of trapdoor (epiglottis) which keeps food from entering during the process of swallowing. If one tries to eat and talk at the same time, the food often goes down the wrong way into the windpipe.

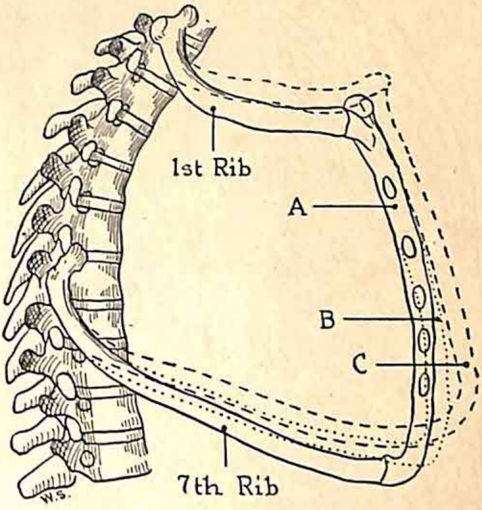
The lungs, an air reservoir. The lungs are suspended on either side of the heart in the chest cavity. They consist of an enormous number of tiny air sacs connected with minute branching tubes which receive air from the windpipe. The whole system of the air supply to the lungs resembles a tree upside down. The average total capacity of the lungs is about 230 cubic inches, one third of this amount (known as residual air) remaining in the lungs after each expiration. Each lung is covered with a membrane called the *pleura*. Another layer of this membrane lines the inside wall of the chest cavity. Between these two layers is a fluid which prevents friction as the lungs move in breathing. Sometimes the pleura becomes inflamed and rough, and the two layers rub against each other. This painful disease is called *pleurisy*. In some cases of pleurisy a great deal of fluid forms between the layers and interferes dangerously with breathing because its pressure interferes with the necessary expansion of the lung.



CHEST BREATHING alone accomplishes a small increase in chest capacity. Diaphragm breathing increases it considerably more. Complete respiration requires chest breathing and diaphragmatic (abdominal) breathing.

How we breathe. Breathing depends on the principle that gases go from areas of high pressure to areas of low pressure. As the chest wall is raised, the air in the lungs is under less pressure than the air outside of the body. The outside air rushes into the air sacs in the lungs until the outside and inside pressures are equal. The lungs have no power within themselves to increase or decrease in size, although they do have a certain normal spongelike elasticity. The expansion and contraction of the lungs depend upon this elasticity and upon the action of the chest wall and the diaphragm.

Inspiration (breathing in) takes place when the chest cavity is enlarged by the action of the diaphragm and the muscles between the ribs. The diaphragm is a dome-shaped muscle, separating the chest cavity from the abdominal cavity. When it contracts, it goes downward, pushing the stomach and intestines downward and bulging the abdominal wall. The muscles attached to the ribs contract, raising the ribs at the sides and the breastbone upward and forward. Thus the size or capacity of the chest cavity is greatly increased in two directions. Expiration (breathing out) is largely a passive act. The muscles relax, and the air is expelled from the chest by the elasticity of the lungs and the weight of the chest walls. Normal, quiet breathing takes place at the rate of sixteen to eighteen times a minute. The rate of breathing is more rapid in children, being as high as forty times a minute in young babies. During sleep, breathing is slower and deeper.



A SIDE VIEW of the chest, showing the breastbone and the first and seventh ribs in position, and the movements of the breastbone and the ribs in breathing: *A*, ordinary expiration; *B*, quiet inspiration; and *C*, deep inspiration.

Exercise and breathing. The greatest amount of oxygen is used during exercise. The best way to increase chest movement, and to make sure that all the lung tissue is being used, is by active

Courtesy Harold M. Lambert

TAKE PART in a sport that is in season. Outdoor exercise improves breathing and the health of all organs, and develops a keen enjoyment in all healthful activities.

physical exercise, such as running. More oxygen is needed to produce energy, and the breathing act becomes more vigorous because of an increase in the amount of carbon dioxide (see p. 235). An active life is necessary to maintain the best chest capacity.

Through a forced breathing, one can easily increase the amount of air taken into his lungs, but this is useless unless one increases the amount of exercise so as to cause increased activity in other organs of the body. The development of lung capacity without a corresponding development of the heart, blood vessels, and muscles is harmful rather than beneficial.

Breathing is carried on by a number of different muscle groups; those extending between the spinal column and the ribs, those between the ribs (intercostal), the muscles of the diaphragm, and the abdominal muscles. The proper use of the voice depends upon suitable breathing; so teachers of singing and voice culture stress lung capacity and have students learn chest and diaphragm control.

In conclusion

BREATHING or respiration is a life process in which oxygen is taken into the body for use by the tissue cells in oxidation, and carbon dioxide is given off as a waste product. Breathing habits affect personal appearance as well as health. Habitual breathing through the mouth instead of the nose may change the expression of the face. Voice and speech depend upon the air which has entered the lungs and is being returned through the larynx.

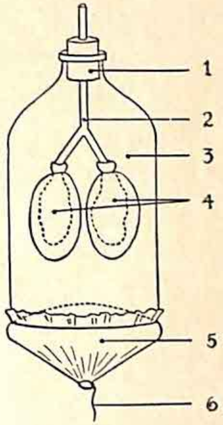
Activities

1. Examine the mouth cavity. While facing a good light and looking into a mirror, open your mouth wide. It is lined with mucous membrane. The roof of the mouth is formed by the hard (bony) palate and, behind this, the soft (muscular) palate from which hangs the uvula. These separate the nose cavity from the mouth. On each side, the soft palate divides into two layers, between which lies the tonsil. In the extreme rear is the sloping wall of the pharynx or throat cavity.

2. Breathe in and out, while pressing the finger against the outside of the right nostril. Do the same with the left nostril. Is the movement of air through the nose free and unobstructed in both passages? If not, what is the probable cause?

3. Close your nostrils and breathe through the mouth. Explain why the mouth becomes dry.

4. Show how air enters the lungs. Construct a model as shown in the diagram, using a one-holed cork, a branched tube, a bell jar open at the top, toy balloons, a piece of sheet rubber, and string. Pull the string gently and hold it. What effect does the lowering of the rubber sheet have on the balloons? Release the string and push up the rubber sheet to form an arch into the bell jar. What happens to the balloons? What body organs do the parts of the model represent? Explain how this experiment may be compared to breathing.



AN APPARATUS to illustrate the mechanics of respiration consists of *1)* a cork, *2)* a branched tube, *3)* a bell jar, *4)* toy balloons, *5)* a rubber sheet, and *6)* a piece of string.

5. Note the effect of fatigue and excitement upon the voices of those around you. What conditions or activities during the past months have caused your voice to be temporarily unpleasant? Enlist the help and criticism of someone else in trying to improve the quality of your own voice.

Test

Directions: On a separate piece of paper make a list of letters from A to J, corresponding to the letters of the definitions given below. After each letter place the number of the term in the list below which best fits that definition. Do not write in the book.

A. A kind of skin lining the nose and throat.
B. Structures that vibrate to produce sound.
C. A condition of the lining of the air passages which may produce an unpleasant voice.
D. A small chamber at the upper end of the windpipe.
E. A gas used by the cells for the burning of food.
F. Passageway from the throat to the lungs.
G. Masses of lymph node tissue located back of the nasal passages.
H. A muscle that separates the chest cavity from the abdominal cavity.
I. Cavities in the bones of the head which connect with the interior of the nose.
J. Tiny spaces in which the interchange of gases takes place.

1. voice box
2. tonsils
3. diaphragm
4. sinuses
5. mucous membrane
6. air sacs
7. inflammation
8. pleura
9. vocal cords
10. oxygen
11. windpipe
12. adenoids
13. oxidation
14. carbon dioxide

Associated subjects

Biology: Respiration as a fundamental life process. . . . The organs of respiration in man. . . . Comparison of respiration in various types of land and water animals.

Chemistry: The nature of air. . . . The properties of the gases making up air. . . . The compounds found in the blood.

Dramatics: The expression of the emotions through control of the facial muscles. . . . The correct use of the voice.

Music: The use and control of the vocal organs and the breathing apparatus.

Physical education: The importance of lung expansion and chest control. . . . The three types of breathing.

Physics: The principles involved in the behavior of gases. . . . Air pressure. . . . The passage of gases through membranes. . . . Sound waves and pitch.

Public speaking: Good enunciation and the effective use of the voice.

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Films

How the Respiratory System Functions. 11 minutes, sound. Bray Studios.
Nose, Throat, Ears. 10 minutes, sound. McGraw-Hill.
The Human Throat. 11 minutes, sound. Bray Studios.

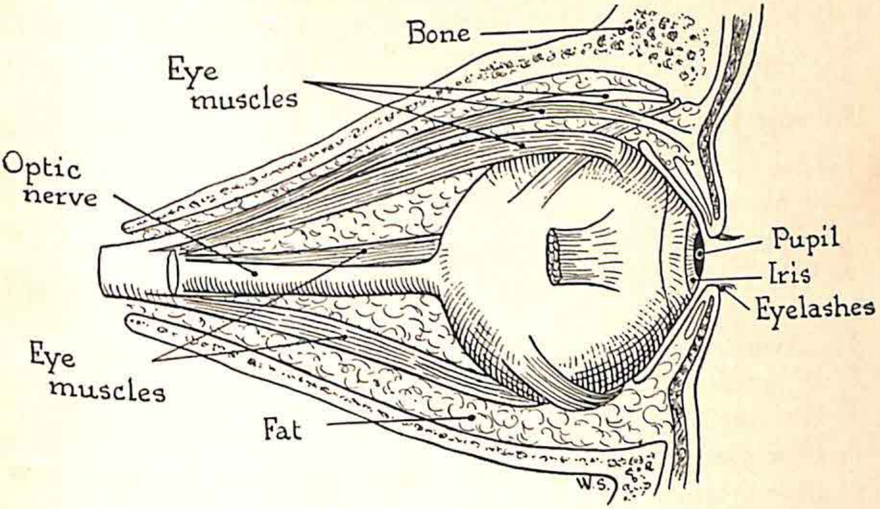
9. GOOD EYESIGHT MAKES LEARNING EASIER

YOUR knowledge of the world depends entirely upon the senses of touch, taste, smell, sight, and hearing. Consider how much information would be lost to you if any one of these avenues were closed. The importance of sight will be discussed in this chapter.

Do you know . . .

1. How we see?
2. What normal vision is?
3. Why a camera may be called an artificial eye?
4. Why one does not see well on coming from a dark room into bright light?
5. At what distance from the eyes a book should be held?
6. What causes weak eyes?
7. How often eyes should be tested?
8. How moving pictures, reading fine print, or loss of sleep may cause eyestrain?
9. Why looking into the sun is harmful?
10. What we call a person who examines eyes for glasses but is not a physician? A medical specialist who examines eyes? A person who merely makes and sells glasses?
11. How one can remove a foreign body from the eye?
12. What causes blurring of vision?
13. How glare may be harmful to the eyes?
14. What are the advantages of indirect lighting?
15. What are the evidences of eyestrain?
16. What farsightedness, nearsightedness, and astigmatism are?
17. What causes bloodshot eyes? Pinkeye?
18. What the cause of cataract is?
19. If eye defects can be cured by wearing glasses?
20. What causes squint or cross-eyes?
21. How eye make-up may be injurious to the eye?
22. Of what value eye lotions and eyewashes are?
23. The objections to plucking the eyebrows?
24. If eye exercises can improve vision?

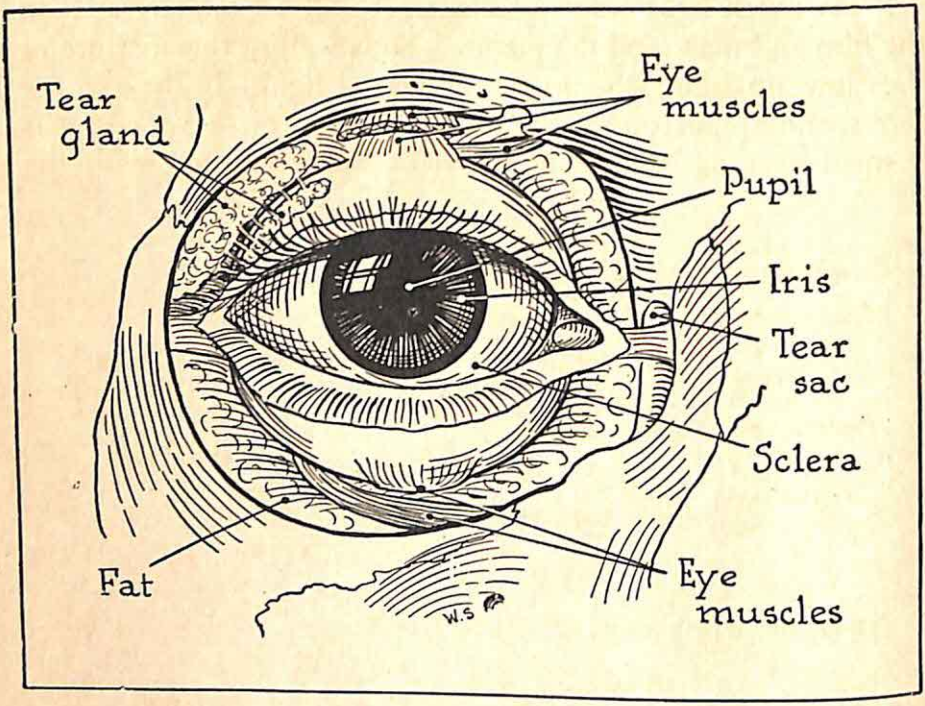
Seeing. Your eyes are the windows between you and the outside world, but how you see this outside world depends upon education and practice. In looking at a field of grain, the picture you see may differ from that of the farmer or the artist. In reading a book, not only must your eyes form a rapid series of accurate photographs, but you must recognize the words and understand their meaning. From the time of arising until bedtime, you are expending much energy in this process of seeing near and far.



SIX SLENDER muscles control the movements of the eye.

The eye and its surroundings. The eyeball is shaped almost like a ball an inch in diameter. It is protected from injury by its position in a deep bony socket called the orbit and is further protected in front by the eyelids and eyelashes. The upper lid closes over the eye like a curtain. The lashes are rows of curved hairs along the edges of the lids. They help to screen the eyes from dust and insects. The eyeball is moved in various directions by three pairs of muscles fastened to it and controlled by nerves.

Some eyes seem larger and more striking than others. This difference is not usually due to the size of the eyeball, which is practically the same for almost everyone, but to differences in size of the opening between the eyelids. The color of the eye (the



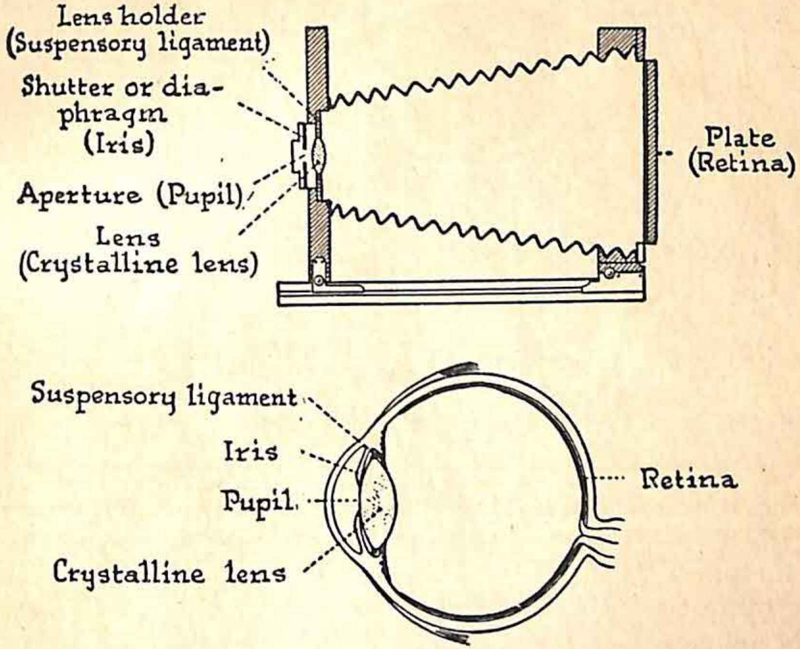
IN THIS front view of the right eye, the eyelid has been partially removed to show the tear, or lacrimal, gland.

color of the iris) varies from light blue to dark brown according to the amount of pigment present.

The tear glands. The front of the eye is kept moist by tears. These are secreted by the tear (*lacrimal*) gland, which lies near the upper, outer edge of the orbit. The tears, after spreading across the eye in a thin film, drain into the nose through two tiny tubes and a collecting sac at the inner corner of the eye. They spill onto the cheek when produced too rapidly to be carried away by the drainage tubes.

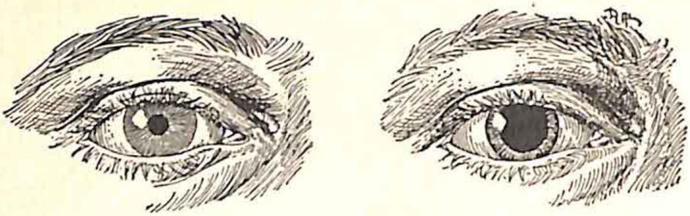
The eye compared with a camera. In many ways the eye resembles a photographic camera. The lens at the front of the camera receives the rays of light from the object to be photographed and bends them so as to form an image on the film. Somewhat in the same way, the lens of the eye (the crystalline lens) forms an image on the retina, the expansion of the *optic nerve* at the back of the eyeball.

If too much light enters a camera, it will act too strongly on the film and may spoil the picture. So we adjust the aperture of the camera to admit the proper amount of light. In the eye, the corresponding aperture is the *pupil*. It looks black because it is a small opening which appears dark by comparison with the greater amount of light outside the eye. The size of the pupil is controlled by the *iris,* the curtain whose color determines the color of the eye. The pupil grows larger in dim light and smaller in bright light, protecting the inside of the eye from excessive light.



USING THESE diagrams, compare the parts of the eye with the camera. In what three ways does the eye differ from the camera?

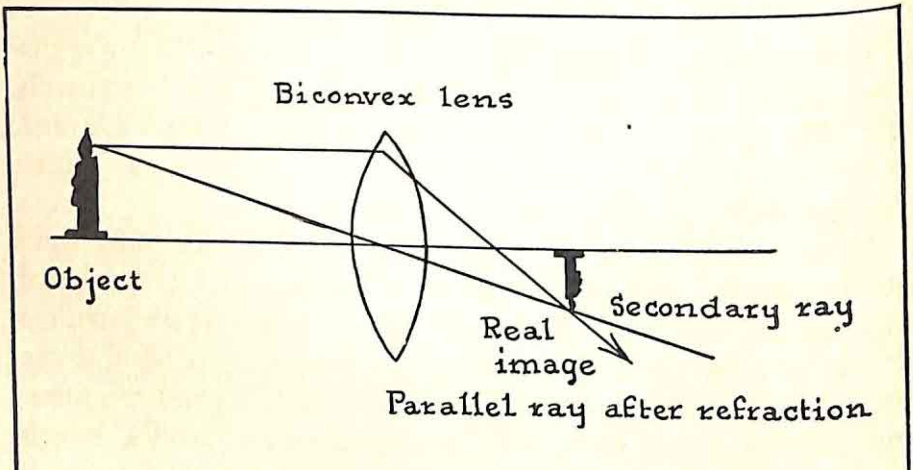
But the eye differs from the camera in several ways. Some distance in front of the crystalline lens is a horny, transparent, dome-shaped covering called the *cornea*. You can see this transparent covering or cornea by looking at a friend's eye from one side while he looks straight ahead. The cornea plays a very important part in bringing the rays of light to a focus on the retina. In the camera, the chamber between the lens and the film is filled with air; while in the eye, the space behind the lens is occupied by a transparent jelly (vitreous humor). Between the cornea and the lens is a watery fluid (aqueous humor).



THE PUPIL reacts to light and to accommodation. *Left,* it is contracted when exposed to light or in looking at a near object; *right,* it is dilated when light is withdrawn or in looking at a distant object.

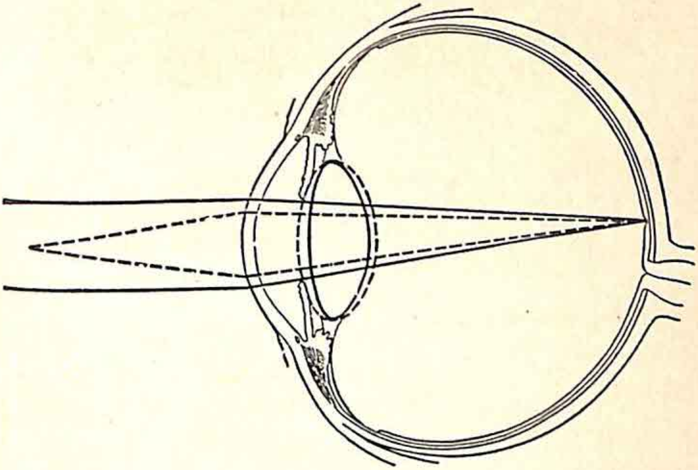
Behind the level of the color of the eye the transparent cornea is continuous with the opaque *sclera* ("the white of the eye"), the tough layer which covers the back four-fifths of the eyeball. At the back of the eyeball the sclera is penetrated by the optic nerve, and to the sclera are attached all the muscles which move the eyeball.

The crystalline lens. In the camera, the focusing of an image on the film is performed by sliding the lens backward and for-



IN THE FORMATION of an image by a biconvex lens, the rays of light are bent to form an inverted image.

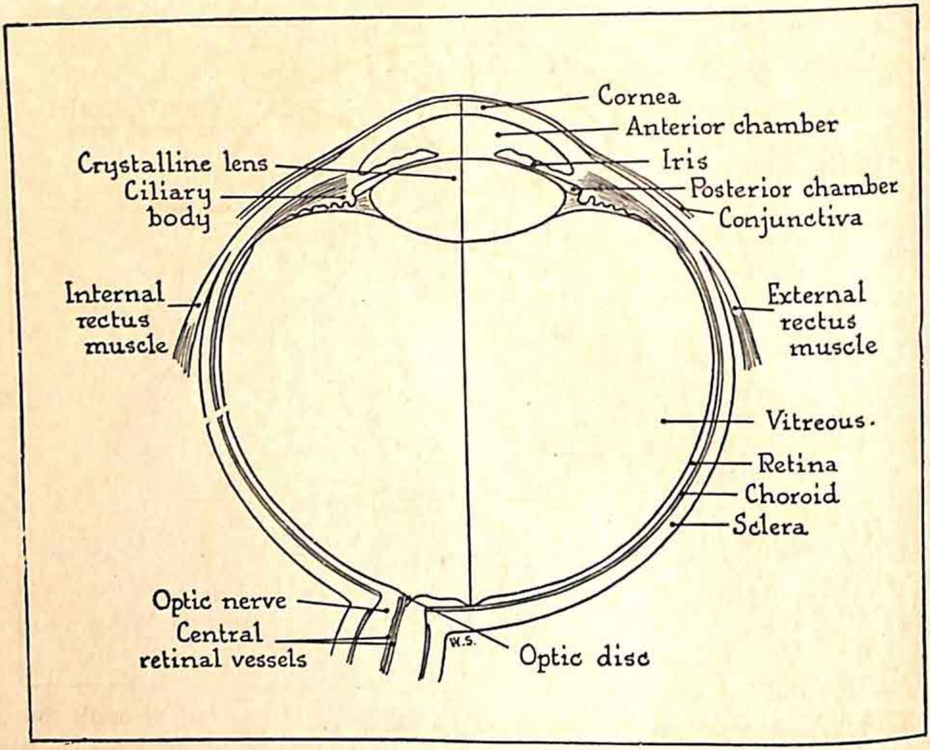
ward. The human eyeball cannot be lengthened and shortened like the camera, so the focusing is brought about by changes in the shape of the crystalline lens due to the action of a group of muscular fibers called the *ciliary muscle*. This alteration in the shape of the lens is called *accommodation*.



TO FOCUS distant objects on the retina, the lens becomes less convex. The solid black lines on the drawing represent rays of light from a distant object. To focus near objects on the retina, the lens becomes more convex. The broken lines represent rays of light from a near object.

In the normal eye, in the position of rest used for looking at distant objects, the front surface of the crystalline lens is relatively flat. For vision at close range, the lens thickens, bulges forward, is more convex. Excessive effort by the ciliary muscle which controls the shape of the lens may cause eyestrain.

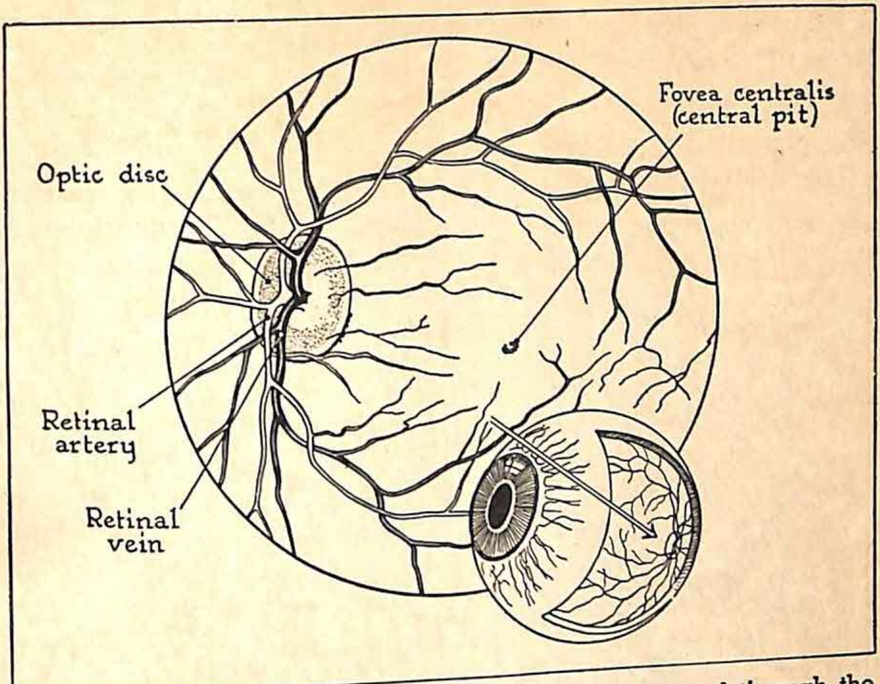
From early childhood the lens gradually becomes more rigid and less capable of accommodation. A young child with normal eyes can see objects plainly as near as four inches or less, while a person of forty years with normal eyes may only be able to see them plainly at six or sever inches. By forty-five years, the minimum distance will likely have increased to ten inches, which hardly gives a convenient margin of adjustment for reading small print. This condition is called old-age sight (presbyopia), even though as a matter of fact it has been developing from early childhood.



NOTE the various parts of the eyeball, as shown in this diagram of a horizontal section of the eyeball.

The retina. Like the film of the camera, the retina is sensitive to light. But the nerve endings in the retina adapt themselves wonderfully to the great variations between bright sunshine and very dim light. The retina communicates light impressions to the brain by way of the optic nerve, of which the retina is really a part. The retina is nourished by its own blood vessels and also by another coat of the eye, the *choroid,* which consists almost entirely of blood vessels. The choroid lies between the sclera, or hard coat on the outside, and the retina, which is the inside coat of the eye.

The optic nerve. The optic nerve is a part of the brain, from which it grows out as a sort of stalk during the early life of the unborn child. It enters back of the eyeball through openings in the sclera and choroid, and spreads out on the inside of the eyeball to form the retina. All sight messages must pass from the retina



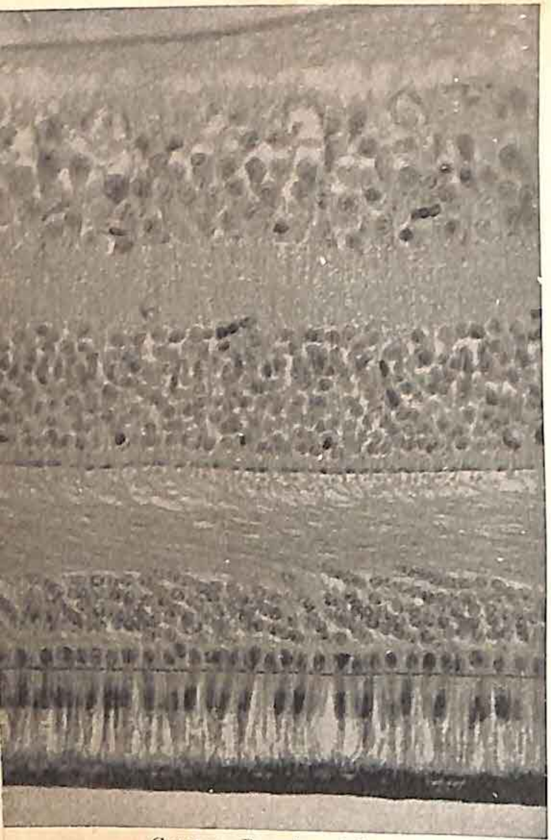
BY MEANS of a special instrument, light can be directed through the pupil into the eyeball, thus illuminating the background of the eye. Here is the retina with its blood vessels and the optic disc.

through the optic nerve to the brain, and damage to any of the paths through which such sight messages are carried will result in more or less loss of vision.

Saving sight. Like any other kind of delicate machinery, the eyes will wear out faster if they are improperly used. Eyestrain may bring on headache, general fatigue, nervousness, and other disagreeable symptoms.

Eyes sometimes become defective or blind at or soon after birth, as a result of infection existing in the parent or, occasionally, in an attendant. To prevent blindness from this cause, the laws of many states require that a few drops of silver nitrate solution be placed in the eyes of each newborn child.

Causes of eyestrain. One may have normal vision and yet suffer severely from eyestrain. Dim light, as well as dazzling reflections, may make the eyes tired and weak. It is best to have the light come from the left and behind, if one is right-handed; and



Courtesy Bausch and Lomb Optical Company

IN THIS PHOTOMICROGRAPH we see a section through the various layers of the retina of the human eye, magnified 200 times. The retina consists of nine distinct layers. At the top of the illustration are layers of nerve fibers and cells lying next to the vitreous humor. At the bottom are the rods and cones by which light impressions are first received. These are separated from the choroid by a layer of pigment. The rods are provided with a light-sensitive material called visual purple.

from the right and behind, if one is left-handed. Remember that the light is meant to see by and not to look at. Good light should come from a steady source, be of sufficient intensity to illumine without glare, and produce no shadows on the reading or working surface. The power of an electric or other light varies inversely as the square of its distance from the object illuminated. For example, at one foot the illumination from a given source of light is four times that at two feet.

Glare results from excessive light falling on the eye. Without serving any useful purpose, it exhausts the retina and other parts of the eye engaged in the sensation of vision and may cause painful contraction of the pupil.

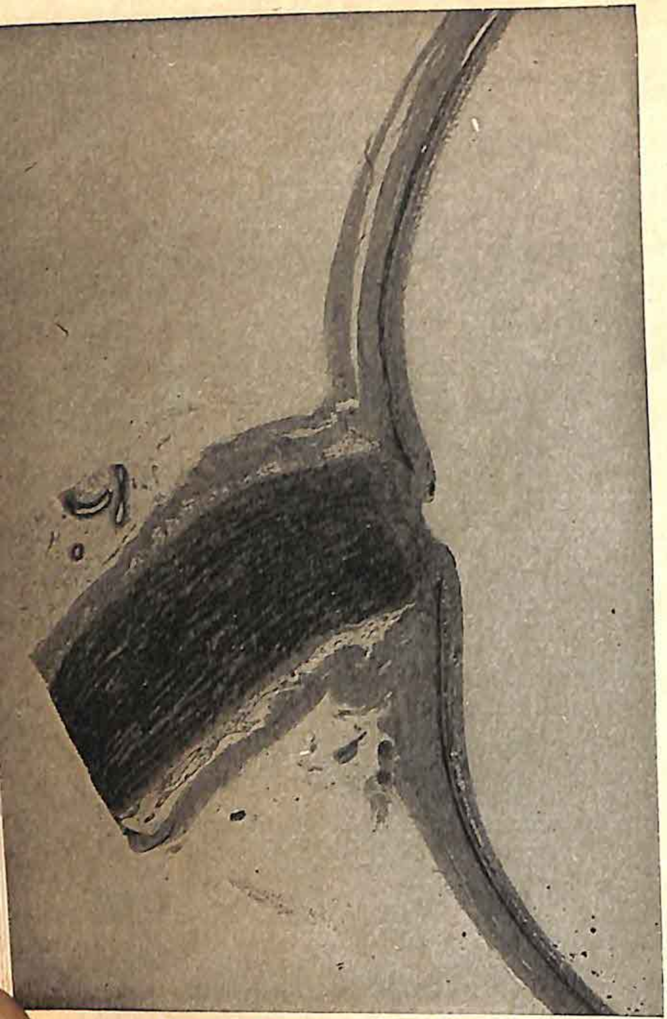
For general lighting of the home, indirect illumination (usually reflected from ceiling or wall) is perhaps most satisfactory. This produces less glare and does not noticeably cast shadows. However, it is often less suitable for near work requiring close concentration, in which a direct light, shaded so as not to shine into the eyes, is preferable.

At the beach or on sunlit snow, eyes often need the protection of tinted glasses. Some of the colored glasses sold over the counter have disturbing optical defects, and it may be safer to buy a good optical glass from a reliable optician. Eyes that are in need of correction for refractive error (see p. 120) are likely to be oversensitive to strong light. Eyes may be seriously injured by looking directly at the sun. It is very dangerous to observe an eclipse of the sun without protecting the eyes by looking through heavily smoked glass or through an extremely dark photographic film. Ordinary tinted glasses are not sufficient to protect against the risk of blindness from this cause.

Fine print and shiny paper strain the eyes.. Clear, black type is the most easily read. Material being read should be held still. The eyes may be strained by reading in moving trains, streetcars, and automobiles—especially when the lighting is insufficient. They may be strained by watching unsteady moving pictures or by sitting too close to the moving-picture screen. Television should be viewed in a room which has some light in addition to that from the screen so that observers will tend to shift their focus frequently to other parts of the room. Persons should be seated so that they look straight ahead at the television screen.

To reduce eyestrain. While reading, sit erect and hold the printed page not less than thirteen inches from the eyes and perpendicular to the line of vision. Concentration is much easier in a good light than in a poor one. Do not read while lying down. If you must read in bed, be well bolstered up in such a position that you can face the book squarely and with the light properly placed (see p. 113). During reading or close work, look away and around the room at frequent intervals to rest the focusing muscle (see p. 111) and the muscles that control the position of the eyes.

The eyes quickly betray lowered states of bodily efficiency. Symptoms of eyestrain may occur in other parts of the body, and ailments in other organs may cause trouble with the eyes. Repeated headaches, dizziness, nausea, vomiting, twitching of the eyelids, sties, or even a general tired feeling may be due to eyestrain. If properly balanced rest and outdoor exercise, or treatment of general disorders, fail to bring relief from such symptoms, it is advisable to consult a competent eye specialist.



Courtesy Bausch and Lomb Optical Company

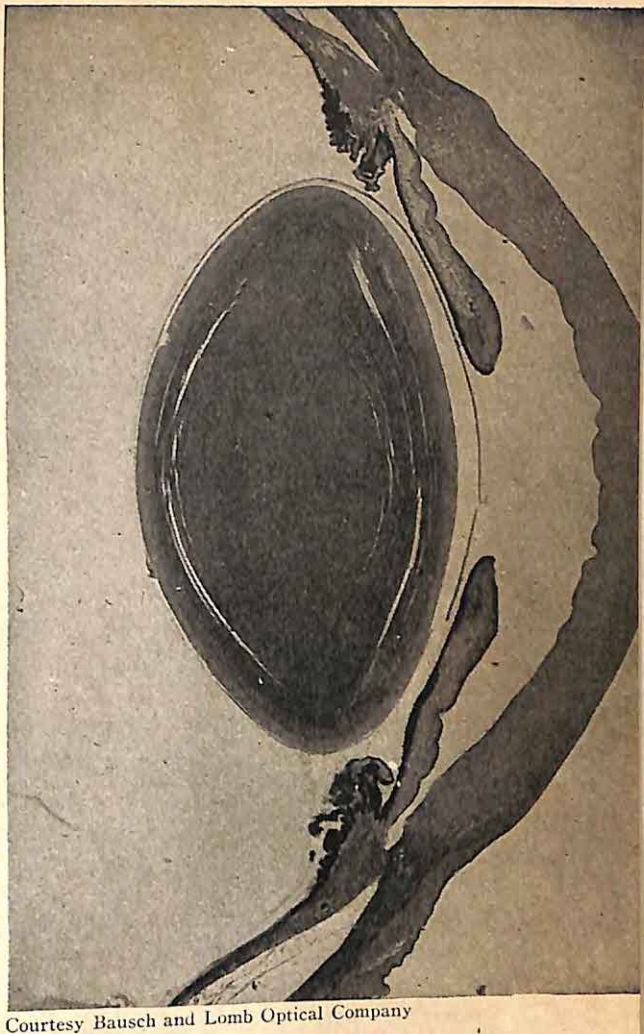
THIS PHOTOMICROGRAPH of a transverse section through the optic nerve shows how the optic nerve enters the eyeball.

A foreign body in the eye. Any solid substance coming from without which lodges on or in the eyeball or under the eyelids is known as a foreign body in the eye. The tears remove many foreign particles from the eye. If a foreign body lodges in the eye, the eye should not be rubbed. One should close the eye very gently without squeezing, and wait for the tears to wash out the foreign body. If a foreign body sticks to the eyeball, it is better to go to an eye physician at once for removal of the offending particle.

It is not difficult to learn how to remove a foreign body that has lodged under the upper lid.

Have the sufferer look steadily downward while you attempt removal. Fold the lid upon itself in the following manner: Take hold of the eyelashes and pull the upper lid downward and forward. Then apply the side of a match or blunt pencil at the upper edge of the stiff part of the lid and push downward and backward. At the same time, pull the stretched lower part of the lid forward and upward, folding the lid upon itself. The foreign body will then usually be seen near the center of the turned-up part of the lid. Wipe it off with the corner of a clean handkerchief, which you have already provided for this purpose.

Eye defects. The most common eye defects result from imperfect shape of the eyeball. These defects of shape, which cannot be cured although generally speaking they can be corrected with properly fitted glasses, are nearsightedness (myopia), farsightedness (hyperopia), and astigmatism.



Courtesy Bausch and Lomb Optical Company

THIS IS a photomicrograph of a transverse section through the cornea, iris, ciliary muscle, and lens. Locate those parts by comparing this illustration with the diagram on page 112.

In *nearsightedness,* or myopia, one cannot see distant objects clearly. The eyeball is relatively too long from front to back, so that parallel rays of light entering the eye from an object at a considerable distance come to a focus before they reach the retina. A suitable concave glass corrects this defect by shifting the focus back to the retina. In some bad cases of nearsightedness, everything beyond three or four inches from the eye appears blurred. In other cases, things within an arm's length may be seen clearly, but not things across the room. Nearsightedness often develops during school life and is apt to be increased by too much close work,

Courtesy H. Armstrong Roberts

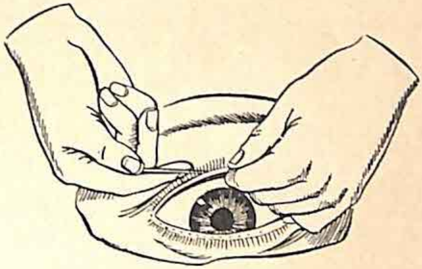
LEARNING is made easier if there is no glare and there are no shadows on the reading surface.

especially under improper conditions. It usually increases much less rapidly after the affected person has reached his full growth.

In *farsightedness,* or hyperopia, one is likely to see distinctly both near and distant objects. One may even be said to have wonderful eyes, although he sees everything with excessive effort. The eyeball is relatively too short, so that if the eye were completely at rest, the rays of light from any object would fail to come to a focus by the time they reached the retina. A suitable convex glass will correct this defect. Only a few persons are so farsighted that they cannot see distinctly in early life.

Astigmatism is another eye defect that causes blurred vision.

The kind of astigmatism that can be corrected with glasses is due to unequal curvature in different meridians of the curved surface of the cornea or of the crystalline lens or both. In this form of astigmatism we have two principal convex curvatures at right angles to each other: one, the greatest curvature, having the greatest focusing effect; and the other, the flattest curvature, having the least focusing effect. Rays of light going through the greatest curvature are bent more sharply and so come to a focus sooner than similar rays of light going through the least curvature. This type of defect is corrected with what is known as a cylindrical lens, that is, curved like the side of a cylinder. Such a lens compensates for the difference between the strongest and the weakest curvatures.

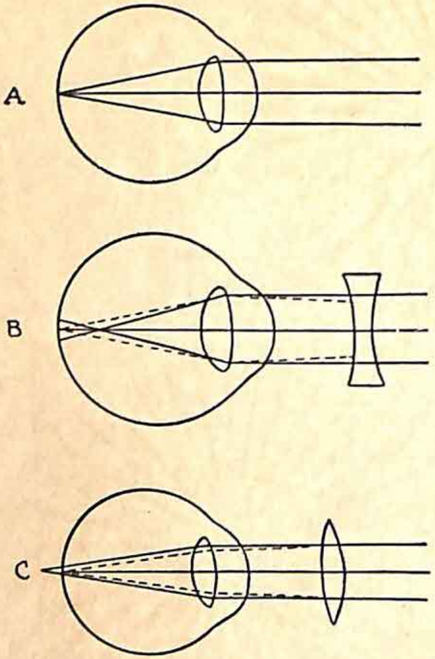


TO REMOVE a foreign body from the eye, roll the upper lid over a blunt pencil or a match stick.

Wearing eyeglasses. If glasses are needed, the eyes should be properly measured for them by a competent eye physician and then the glasses should be worn. Boys and girls who neglect wearing needed glasses often do damage to their eyes and nervous systems, besides impairing their general efficiency. Anyone who has difficulty in seeing the blackboard should not hesitate to ask for a seat near the front of the room.

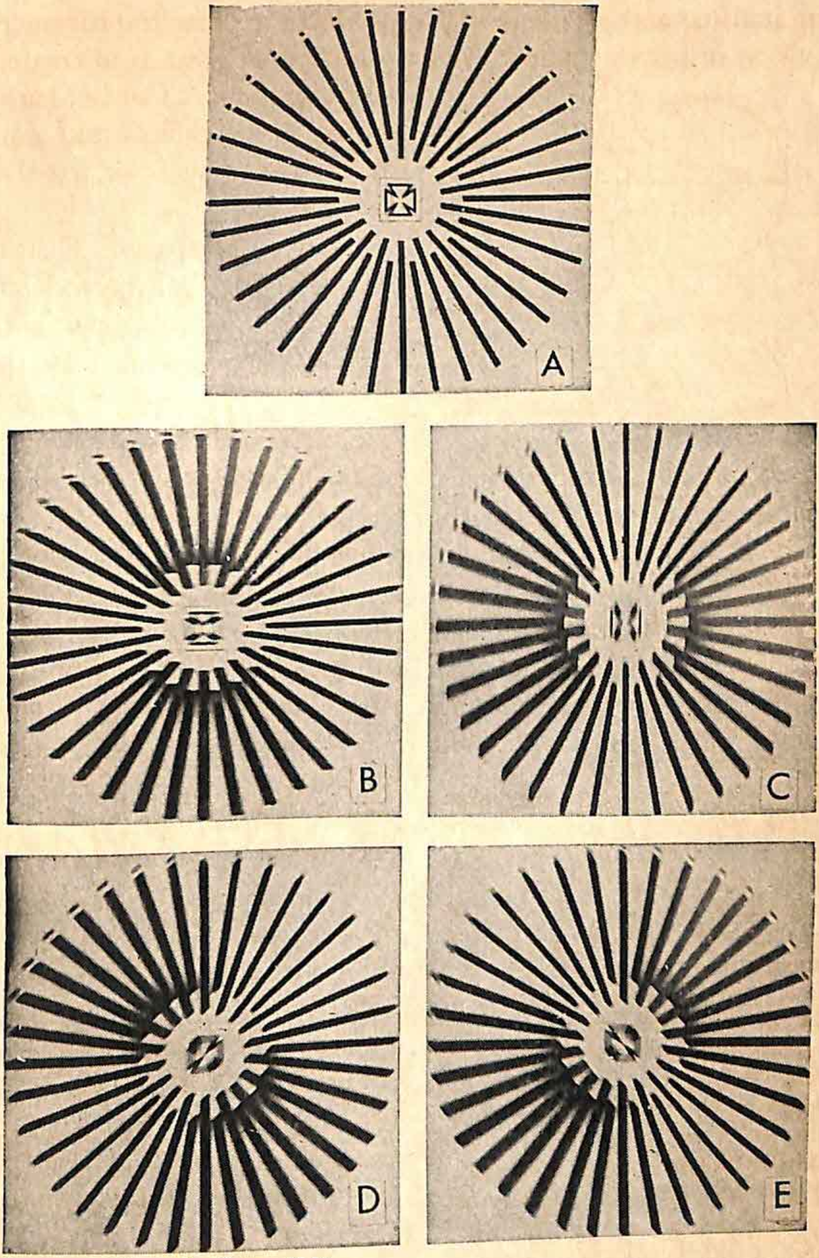
The fact that more eyeglasses are used now than formerly does not signify that eyes are growing weaker. Under modern conditions eyes are used more strenuously than ever before. On the other hand, the technique for the correction of eye defects is better understood and more frequently applied.

For some very seriously defective eyes, or in the case of actors and a few other groups who find it extremely desirable to avoid the wearing of glasses in public, what is known as a *contact lens* is applied directly to the front of the eyeball inside the eyelids. On account of the fact that there is only a thin layer of fluid and no air between it and the cornea, the contact lens abolishes astigmatism, and so occasionally produces a great improvement in vision in persons whose eye deformity is so great as to create a severe disability. Contact lenses are expensive, difficult to fit and to insert, and more or less irritating to the eyes.



IN A NORMAL eye (*A*), the parallel rays of light come to a focus on the retina, producing a clear image. In the myopic, or nearsighted eye (*B*), the eyeball is too long; and the parallel rays of light meet in front of the retina, producing a blurred image. In the hyperopic, or farsighted eye (C), the eyeball is too short; and the parallel rays fail to reach a focus, thus producing a blurred image on the retina. The dotted lines in *B* and C represent the paths of the rays after correction by concave and convex glasses.

Color-blindness. Color-blindness is an inherited defect found more often among men than among women. In the commonest form of color-blindness there is inability to distinguish red from green. In the most extreme form there is no sense of color, but all colors are seen as varying shades of gray. There is no correction for these defects. Color-blindness is especially dangerous in trainmen, sailors, and aviators because of their dependence on colored signal lights. This is the reason that eyes of trainmen, sailors, and aviators **must** be tested for color vision **before** they are given **employment**. Color-blindness disqualifies a candidate for service as a pilot in the Army or Navy, as well as for commercial flying. All drivers of motor vehicles should be able to distinguish between red and green signals. The presence of color-blindness calls for special care. People with color-blindness have to depend upon other factors, such as varying shades of gray and movement of traffic. In some cases they are refused an operator's license to drive.



Courtesy William H. Crisp, M.D.

FIGURE *A* is a chart which, in larger form, is used to test for astigmatism. *B, C, D,* and *E* show appearances of this chart to different persons with pronounced astigmatism, the sharpest line being usually at right angles with the flattest curve of the cornea.

Other eye disorders. In young people, what is known as *cross-eye* or *squint* is usually due to an exaggerated action of the muscles which turn the eyes toward the nose. Such exaggerated "turning in" of the eyes may depend chiefly upon failure of the brain to develop what is known as binocular vision, that is, the power of forming one picture out of the two separate pictures received by the two eyes. However, most cases of cross-eye in young people are related to farsightedness, and, if cared for early enough, can be relieved by the wearing of proper convex lenses. Some other kinds of cross-eye are caused by special birth defects or by paralysis of eye muscles. Treatment for cross-eye should be used as early as possible.

Aniseikonia ("unlike images"). Ordinarily the two eyes receive separate and somewhat unlike pictures which are then forwarded to the brain. At the fusion center of the brain these two pictures are blended into one picture which gives a sense of depth or perspective (as contrasted with the flatness of a picture formed by one eye only). If the eyes and the fusion center of the brain are quite normal, the two pictures are of equal size and readily blend or fuse into one. In the defect known as *aniseikonia* the images received by the brain are unequal in size, either because of defects in the eyes or because of some defect in the brain's interpretation of the images. It thus becomes difficult for the brain to blend the separate images into a single picture. The person may merely experience discomfort, or he may be unable to use the two eyes together. Aniseikonia is corrected by using special "size" lenses, the purpose of which is to modify the relative size of the two images. The apparatus used for measuring this defect is extremely complicated and expensive. Only a few laboratories or clinics for the purpose have been established.

Another important disorder of the eye, called *cataract,* occurs rather frequently in the eyes of elderly people. The lens, which is normally transparent, becomes cloudy, sometimes to the point of producing blindness. The remedy for this is an operation to remove the cloudy lens. The earlier action of the natural lens in focusing rays of light must then be secured by putting a strong convex glass in front of the eye.

Diseases of the eye. Various parts of the eye apparatus may get out of order. The eyelids or tear passages may suffer from infection. If the tear passages are blocked, the eye may constantly weep.

The lining of the eyelid and the covering of the white of the eye (both called *conjunctiva*) may become badly inflamed. This may be caused from a number of sources, usually types of virus infections. *Pinkeye* is a contagious infection of the conjunctiva. The common cold frequently causes irritation. For any severe inflammation, an eye physician should be consulted as soon as possible.

A mild form of granulated eyelids or crusty lids often arises from eyestrain, errors in diet, or exposure to weather conditions, or as a result of infection. A much more contagious and serious type of granulation of the inner surface of the eyelids is known as *trachoma*. This is more common in many other countries than in the United States, although it is often found among the Indians and among the poorer type of white population in certain sections of our country. Recent investigations seem to indicate that trachoma is a virus disease (see p. 383).

A *sty* is a boil in or around the root of an eyelash. Sties often result from eyestrain, but are encouraged by errors of diet, especially excess of sugar.

Because of contagious conditions that may exist in the eye, one should always use an individual washcloth and towel.

Injuries to the eye. A "black eye," like a bruise elsewhere, is due to the breaking of blood vessels in the soft tissues. Perhaps the most helpful treatment is to apply ice or cold wet compresses as soon as possible, or one may alternate hot with cold applications. Speedy results must not be expected from any method used. Poultices, hot compresses, and pounded beefsteak are of little value in reducing the discoloration.

There is evidence that very thorough irrigation with water is an excellent method for removing acids and alkalies which have been splashed into the eye.

In addition to the risks associated with many healthful games, it should be remembered that serious accidents to the eye are

Courtesy *Hygeia* Magazine

THIS YOUNG aviator is wearing goggles made with a special glass which automatically sorts light rays, absorbing undesirable indivisible rays and dazzling glare, and transmitting at the same time useful, visible light.

likely to be caused by air rifles (B.B. shots), firecrackers, arrows, hard snowballs, rubber bands, and other missiles.

Infection may occur by touching the eyes with the fingers. Unless thoroughly clean, fingers should be kept away from the eye.

Examining the eyes. The eyes of every school child should be examined each year. If the test made by the school nurse or teacher shows defective vision or suggests the presence of eyestrain, examination by an eye specialist is recommended. These annual screenings show that, on the average, one out of every ten children has an important eye defect.

Vision is tested by the use of a chart carrying letters, numbers, or other symbols. The person tested usually sits at a distance of twenty feet from the chart and attempts to read the letters or other symbols. Each eye is tested separately, the other being kept covered. The vision of the eye is stated as a fraction by putting above the line the distance at which the type is actually read and below the line the maximum distance at which it is assumed the type should be read by the normal eye; thus, $^{20}/_{20}$ is considered as normal vision.

An *oculist* or an *ophthalmologist* is a physician who specializes in the treatment of all eye disorders, including defects of vision which call for glasses. An *optometrist* is a person licensed by the state to correct defects of vision with glasses. An *optician* is one who grinds lenses for eyeglasses according to a formula or a prescription.

Eyesight in aviation. In the examination of young men for general military service under the Selective Training and Service Act of 1940, nearly 14 percent of those physically disqualified had defects related to the eyes. The standards set by this Act are not so rigid as those required of aviators and army pilots.

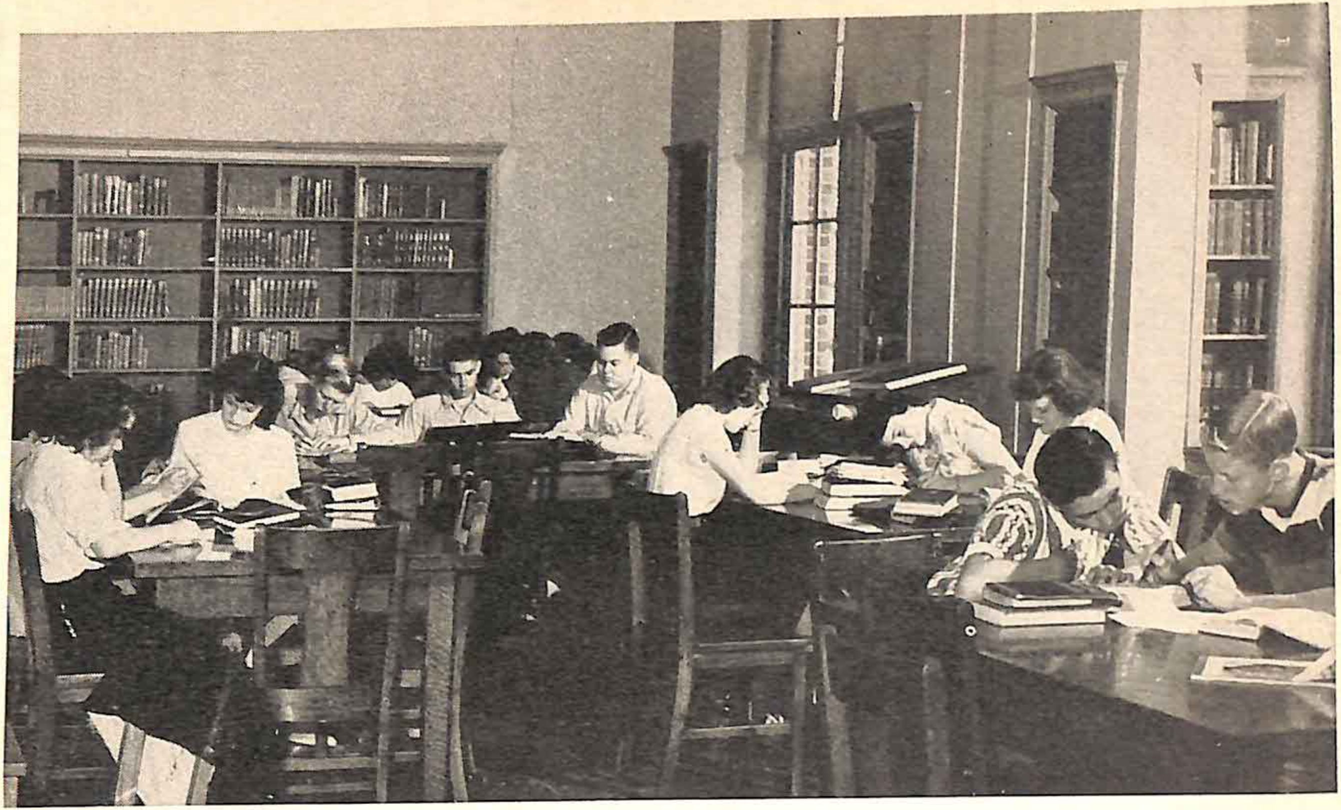
It is obvious that an aviator should possess very accurate vision. It would be dangerous for him to see inaccurately. For example, he must not only be able to see landing fields clearly, but also any obstacle in the vicinity. He must be able to observe the direction in which the wind sock is being blown and to read the names of towns painted on the roofs of buildings.

A pilot must have good accommodation so that in addition to seeing distant objects clearly he may be able to read promptly such near information as is shown by the gauges on the panel of his airplane. He must be able to compare the location of ground objects with the details shown by a map. He must also have good depth perception; otherwise, he will not be able to judge distances at the time of landing. Special glass in aviators' goggles reduces glare and relieves eye strain and headaches.

Is eye care worth while? Eyes that are healthy and are functioning properly do not need special attention. It is not safe to use drops to dilate the pupils for the purpose of making the eyes look more striking. There is risk in the use of such drops except under observation by an oculist in his examination or treatment.

Eyelash and eyebrow dyes are often definitely poisonous and not infrequently cause irritation and inflammation. At best, the effect is unnatural, and the risk varies all the way from eye irritation to total loss of sight.

To pluck ragged hairs from the eyebrows may be excusable, but to many there is something repulsive about the removal of the whole eyebrow and its replacement by a penciled line. The uniformity of the wide-eyed, surprised expression in persons with plucked eyebrows detracts from individuality and personality.



Courtesy Denver Public Schools

EYESIGHT is a priceless possession through which knowledge is obtained. Look about a library and observe the number of students who abuse their eyes. Many have glare or shadow on their books. Poor posture increases strain on the eyes.

A penciled line also flattens the face and makes it look less intelligent.

Eyedrops. There are no solutions in common use that are uniformly beneficial to the eye. Some commercial eyedrops do little harm, but their use may delay proper treatment. They contain inexpensive substances, such as borax and salt, and are sold at high prices. A saturated solution of boric acid (1 part in 25 parts of water) is a popular eyewash. It is harmless and may be mildly beneficial in the presence of an irritation or slight infection. A soothing and cleansing eyebath, to be used in an eyecup, may be made by dissolving one level teaspoonful of common table salt in a pint of lukewarm water.

Eye quackery. There are many fads, patent medicines, and quacks in the eye field, including mail-order spectacle-fitting concerns, and mechanical devices and exercises for curing eyes. It is agreed by all eye physicians that any method which prescribes throwing away glasses and correcting every eye defect by certain exercises is at best useless and is often actually injurious to the eye. Permanent injury to eyesight may result from neglecting to wear proper glasses.

In conclusion

MOST important of all is to know, as far as possible, how to avoid injury to the delicate mechanism of the eye. Many eye defects can be compensated for by the use of properly fitted glasses. Any type of self-medication or patent-medicine treatment of the eyes is hazardous.

Activities

Study the parts of an eye. Obtain from the slaughter house, or through your butcher, the fresh eye of a pig (best), sheep, or calf. Trim off any tags of flesh or eye muscle. Having previously obtained a half-pint ice cream carton which you have filled with cracked ice mixed with two or three teaspoonfuls of salt, plunge the animal eye into this mixture and allow it to remain there for fifteen or twenty minutes. (The eyeball will then be frozen firm, so that you will not spill its fluids in further handling.) Slightly soften the outside coat by running warm water on it for a second. Then with a sharp razor blade cut the eyeball across its middle into back and front halves. In the back half you will see, through the jellylike vitreous fluid, the entrance of the optic nerve, and the dusky-red retina with blood vessels running across it. You can observe the choroid with its brown pigment between the white sclera on the outside and the delicate retina on the inside. In the front half of the eyeball you will see the crystalline lens, lying behind the opening called the pupil; also, you will see the remainder of the retina and the front chamber of the eye (filled with a watery fluid, aqueous humor), lying between the iris (color of the eye) and the clear cornea.

Test

Directions: On a separate piece of paper make a list of letters from A to L, corresponding to the letters of the statements below. Place a check mark (√) after the letter if the term in italics is correctly used within the statement. If the term in italics is incorrectly used, place an X after the letter, and next to this write the number of the term in the list below which you think would be correct in the statement. Do not write in the book.

A. The curved hairs along the edges of the eyelids are *eyelashes.*
B. The eye is kept moist by a secretion from the *mucous lining.*
C. The part of the eye sensitive to light is the *optic nerve.*
D. The inner part of the eye that bends the light rays to form an image is the *lens.*
E. The opening through which light enters the eye is the *pupil.*
F. The curtain which controls the size of the opening into the eye is the *cornea.*
G. The alteration of the shape of the lens is called *accommodation.*
H. The space behind the lens is filled with a transparent *watery fluid.*
I. The transparent, dome-shaped covering some distance in front of the lens is the *cornea.*
J. A defect of the eye resulting from the eyeball being too long from front to back is *farsightedness.*
K. *Astigmatism* occurs when the lens loses its transparency.
L. A physician who specializes in the treatment of all eye disorders is an *ophthalmologist.*

1. light ray
2. ciliary muscle
3. glare
4. iris
5. eyebrows
6. jelly
7. tear gland
8. nearsightedness
9. retina
10. cataract
11. sclera
12. optometrist
13. refraction
14. focus.

Associated subjects

Biology: The structure of the eye. . . . How we see. . . . The need for special care of the eyes.

Health service: Testing the sight of pupils of the public schools.

Home economics: The proper placing of lights in the home.

Physical education: The testing of vision carried on in co-operation with the health service department.

Physics: Lenses and how they produce images. . . . How one lens may modify the effect of another.

References

Carlson and Johnson. *The Machinery of the Body.*
Fitzpatrick and Stiles. *The Biology of Flight.*
Goldberger and Hallock. *Health and Physical Fitness.*
Meredith. *Health and Fitness.*
National Society for the Prevention of Blindness. Miscellaneous Publications.
Wheat and Fitzpatrick. *Health and Body Building.*
Williams. *Healthful Living.*

Films

Eyes and Their Care. 18 minutes, sound. Encyclopaedia Britannica.
How the Eye Functions. 14 minutes, sound. Knowledge Builders.

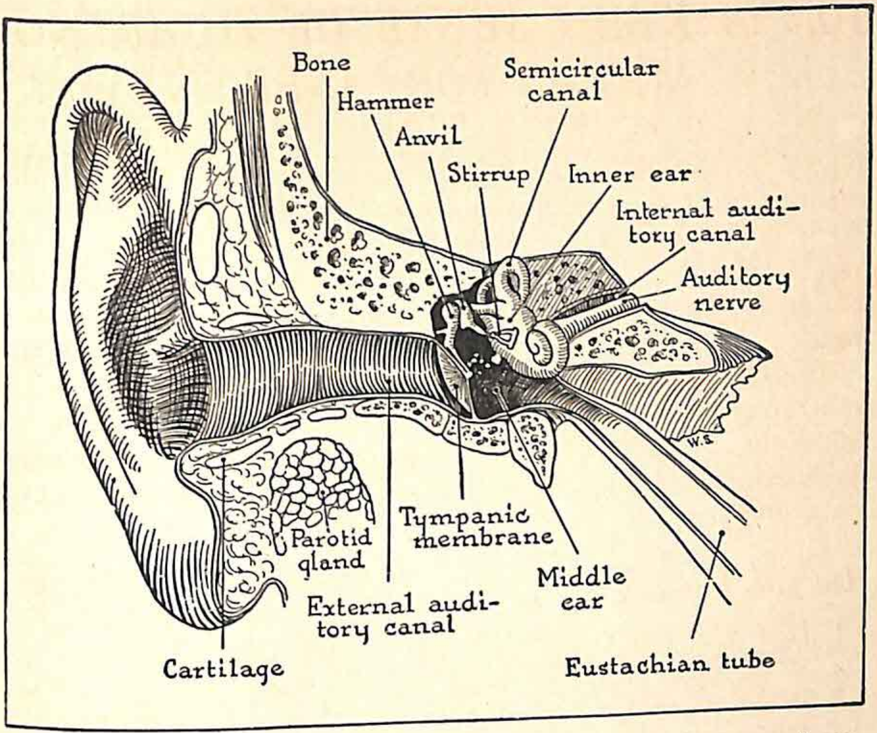
10. A KEEN SENSE OF HEARING MAKES FOR ALERTNESS

NEXT to sight, hearing is the most important sense. Through the ears one becomes aware of sounds that vary greatly in quality and intensity. These sounds result from vibrations whose frequency ranges from 32 to 32,768 per second. But until the vibrations reach the rate of about 50 per second, sound is more like a buzz than a tone.

The ears are not injured by ordinary noises, even if continuous, but the nervous system is affected. Explosive vibrations of air do affect the eardrum. Quiet and harmonious sounds are decidedly beneficial and restful, unless they interfere annoyingly with mental concentration.

Do you know . . .

1. How we hear?
2. What causes deafness?
3. What causes humming in the ear?
4. What makes the eardrum pop?
5. If it is good to put warm oil in the ear?
6. How one can stop earache?
7. Why hearing is affected when one has a cold?
8. How diseased tonsils can injure the ear?
9. How lip reading helps those who are deaf?
10. How air pressure changes in the middle ear?
11. The purpose of the wax glands?
12. What part of the ear controls balance?
13. Why the eardrum should be protected while a person is swimming and diving?
14. What part of the ear is affected in dizziness?
15. Why the sense of equilibrium is so important to air pilots?
16. What nerve controls hearing?
17. How hearing of school children is usually tested?
18. How sound is produced?
19. What parts of the ear are set in motion by sound waves?
20. How the brain is related to hearing?
21. How a hearing appliance may aid the partially deaf person?

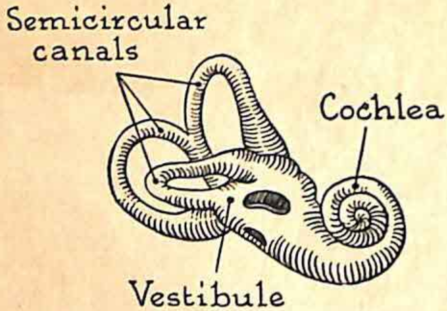


THIS DIAGRAM shows the external, the middle, and the internal ear. The tube leading from the throat to the middle ear is shown also.

External ear. The ear consists of three parts: the external, the middle, and the internal ear. The external ear includes the visible part and the auditory canal. It collects and transmits the sound waves of the air to the drum membrane at the inner end of the canal.

The skin lining the auditory canal contains wax-making glands. The wax is normally pushed out as soon as it is secreted. This keeps the ear canal clean. The wax lubricates the wall of the auditory canal and the eardrum. Wax accumulating in the canal may cause temporary deafness and an annoying buzzing sound. If this occurs, a physician should be consulted. It is well to remember that attempts to clean out the wax for oneself with matchsticks, toothpicks, or hairpins may injure the drum membrane. Water should be kept out of the ear as much as possible. It is also unwise to drop oil into the ear canal unless so advised by a physician, since oil may help the wax to become caked and so press against the eardrum.

Middle ear. Three small bones in the middle ear connect the drum membrane (tympanum) with the internal ear. One theory is that the tympanum with the bones soften certain vibrations reaching the internal ear; another, that they intensify the vibrations.

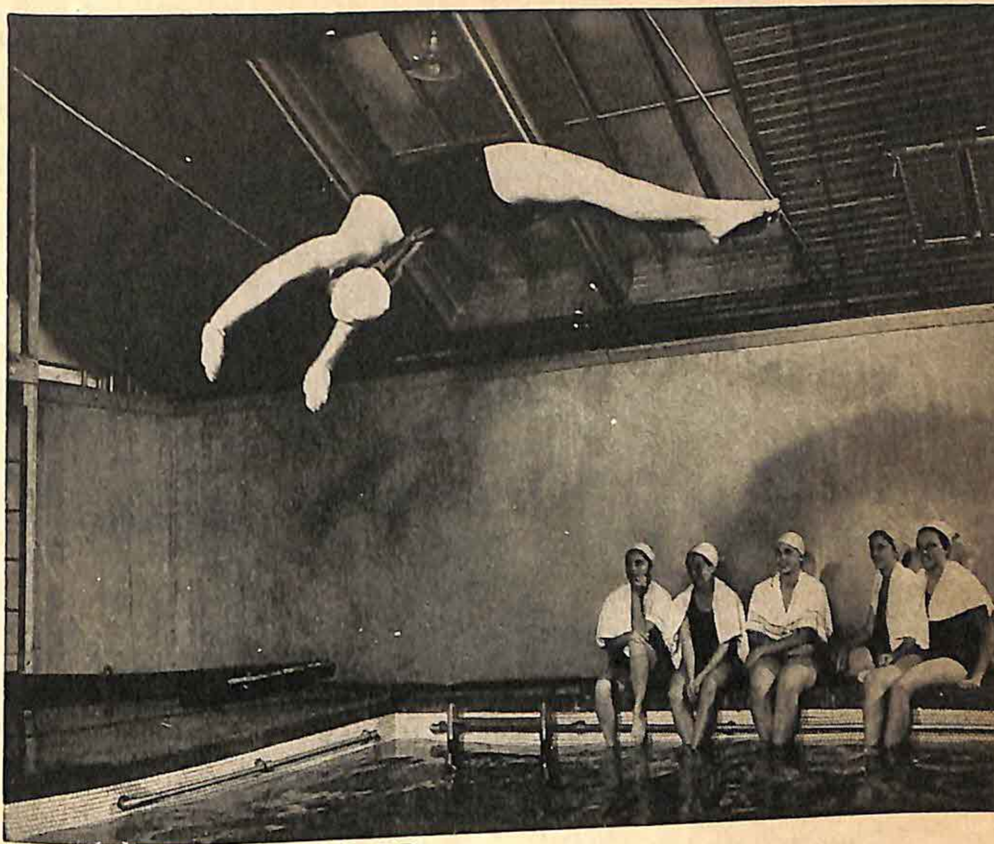


THE COCHLEA, a part of the internal ear, is the organ for receiving sound waves; and the three semicircular canals are concerned with equilibrium.

A tube known as the *Eustachian tube* leads from the throat, just behind the nose, to the middle ear. The purpose of this tube is to equalize the air pressure inside and outside the drum membrane. The throat end of the Eustachian tube is opened in the act of swallowing, and this act, automatically and unconsciously performed, serves to keep a balance between the air pressure inside the eardrum and that outside the eardrum. It is because of the change in air pressure on the internal side of the eardrum that we often notice a "popping" of the ear when coming down a mountain or out of a tunnel.

Internal ear. One part of the internal ear is called the *cochlea* because of its resemblance to a snail shell. It is filled with a fluid and contains the endings of the auditory nerve or nerve of hearing. When set in motion, the fluid stimulates nerve endings from which the impulses are carried to the hearing area of the brain.

Another part of the internal ear is known as the *semicircular canals*. These are the organs of equilibrium or balance. They occupy three distinct planes: one horizontal, and the other two vertical but at right angles to each other. The canals contain fluid, the movement of which—as we change our position—causes pressure on the delicate nerves in the canals, and so sets up impulses that are carried to the brain. Disturbance of these canals by turning around suddenly produces dizziness; and the movements of a ship, an airplane, or even a swing may cause nausea.



Courtesy George School, George School, Pa.

DIVERS should protect their eardrums by wearing caps.

This sense of equilibrium is more important to air pilots than the sense of hearing. Each air pilot must take, and show normal reactions toward, certain tests.

Causes of deafness. Nose and throat infections cause many ear troubles by traveling along the Eustachian tube to the middle ear. At such times, inflammation and swelling of the Eustachian tube may cause temporary deafness, and sometimes the damage may prove permanent. Blowing the nose too forcibly or improperly (see p. 98), especially during a cold, may carry nasal secretions to the middle ear along the Eustachian tube.

Diseased tonsils or enlarged adenoids may cause more or less deafness by obstructing the ventilation of the middle ear through the Eustachian tube or by actual infection of the tube and of the middle ear. Various infections, including especially scarlet fever, measles, and influenza, often cause such inflammation.

Pus may form and the drum membrane may thus become ruptured or may have to be opened by a physician to relieve pain and pressure. A running ear demands consulting a competent ear physician as soon as possible. Sometimes an infection becomes chronic, and varying degrees of deafness may result. The infection may extend into the bony prominence behind the ear (mastoid process) and even into the brain, with serious or fatal results. Mastoiditis is one of the most dangerous of the possible complications that may result from a cold.

Protecting against earache. An occasional attack of earache may be relieved by application of heat in the form of hot, dry cloths or a hot-water bottle placed against the side of the head. Severe earache should always receive skilled attention in order that the new antibiotics may be used promptly to prevent mastoid disease or permanent deafness.

When swimming or diving, protect the eardrums by wearing a cap or using earplugs.

Testing hearing. In the schools of some cities, all pupils are tested for acuteness of hearing with an apparatus called an *audiometer*. This apparatus consists of a phonograph with earpieces for each member of the class. In a quick, interesting, and accurate way slight hearing defects can be easily discovered. Recent examinations in the Detroit public schools showed that 4.4 percent of the children had defective hearing.

Those whose hearing is very defective should be given an opportunity to learn lip reading. The art of lip reading has become well developed in recent years and is bringing comfort to many people.

Helping the deaf. Deafness rarely begins suddenly in adult years. It often arises in childhood in some condition, as a blow on the ear, which is considered at the time to be of little importance.

Moderate deafness has been found to account for apparent backwardness and lack of spirit in some school children. A very deaf person tends to develop a peculiar temperament and an atti-

Courtesy Ewing Galloway

THE BEAUTY and rhythm of music—from symphony orchestra to swing band—belong to those whose hearing is good.

tude of irritability. He often withdraws from others and is inclined to brood over his isolation. He suspects that people are talking about him. Sound is rarely shut off entirely, and some vibrations or noises may prove very annoying to a deaf person.

The so-called deaf and dumb are greatly misunderstood. They are rarely dumb in any sense of the word. Usually their failure to speak is due to their inability to hear. Normal individuals acquire speech by imitating others. Individuals deaf from birth or from early childhood have never had opportunity for such imitation, but they can be trained first to read lips and then to use articulate speech.

The hard of hearing. Most elderly people lose more or less of the sense of hearing. In fact, it is somewhat rare to reach old age without becoming hard of hearing. Such deafness is sometimes due to increased rigidity of the parts of the middle ear and sometimes to degenerative changes in the nerve paths which carry sound impressions to the brain.

Unfortunately, it is often impossible to obtain any great improvement after deafness has developed. But many cases of hard of hearing can be helped by electrical or other appliances which intensify the sound vibrations. Such persons should avoid falling into the hands of quacks who employ unscientific methods of treatment and make extravagant promises. We should all do our part to try to make those who are hard of hearing as happy as possible, by being especially patient with them and by trying to avoid making them feel that they cannot participate in the activities of those around them.

In conclusion

IT IS important to know as far as possible how to avoid harm to the organ of hearing. In early youth hearing is most highly developed. A child can detect 20,000 vibrations per second, whereas a person fifty years old can perceive only 13,000 vibrations per second. As one grows older, the ability to hear gradually decreases. The misfortune of deafness may be diminished by the use of a suitable hearing apparatus or by learning to read lips.

Activities

1. Strike a tuning fork and hold it parallel to the surface of water in a glass tumbler. How is the water affected? What happens to the air between the water and the vibrating tuning fork? How do vibrations in the air affect the ear membrane?

2. Analyze the cause of the disturbance in the ears that sometimes occurs as one goes up in an elevator or down into the subway.

3. Examine the claims made concerning devices advertised to aid hearing. Consult a physician to determine which devices may be useful and which may be fraudulent. How do the ear trumpet, the electric microphone, and "bone contact" devices assist in hearing?

Test

Directions: Copy the following list of words on a separate sheet of paper. Place a check mark (✓) before each word with which you are not familiar or which you could not use correctly. After each word that you have not checked, write a sentence in which you use that word or expression correctly, and in a way that shows an understanding of its meaning. Do not write in the book.

1. auditory canal
2. eardrum
3. Eustachian tube
4. semicircular canals
5. equilibrium
6. mastoid
7. audiometer
8. lip reading
9. anvil
10. internal ear

Associated subjects

Biology: The structure of the ear. . . . How we hear. . . . The need for special care of the ears.

Health service: The tests for hearing ability of all pupils of the public schools.

Physical education: The tests for hearing carried on in co-operation with the health service department.

Physics: The nature of sound—how it may be produced and how it travels.

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CARLSON and JOHNSON. *The Machinery of the Body.*
CLEMENSEN and LAPORTE. *Your Health and Safety.*
FITZPATRICK and STILES. *The Biology of Flight.*
HOWARD. *Your Health and Personality.*
MEREDITH. *Health and Fitness.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*

Films

How the Ear Functions. 14 minutes, sound. Knowledge Builders.
Nose, Throat, Ears. 10 minutes, sound. McGraw-Hill.

11. SUITABLE CLOTHES HELP US TO FORGET OURSELVES

CLOTHES do *not* make the man, but surely they play an important part in the impression we make on other people. They affect us as individuals. They add to our self-respect and are a definite factor in the maintenance of health. In selecting clothes, comfort, cleanliness, becomingness, durability, suitability for the occasion, and consideration of the budget are important.

Do you know . . .

1. If girls' clothes in general are more hygienic than boys' clothes?
2. What part clothing plays in our personality?
3. Whether one should wear underclothing?
4. What is the value of sun suits?
5. Whether one should wear heavier clothes in winter than in summer?
6. Why some materials are warmer than others?
7. Why styles of clothing change so often?
8. Upon what factors the selection of clothing should depend?
9. Why it is unhealthful to wear damp clothing?
10. Why washing hose after each wearing makes them wear longer?
11. Why all persons do not require the same amount of clothing?
12. Why athletes put on extra sweat-suits after strenuous exercise?
13. Why it is unhealthful to wear clothes with tight bands?
14. What is the fundamental purpose of clothes?
15. How clothing is related to health?
16. How clothing keeps the body comfortable?
17. Why exposure of the body to sunlight is not always beneficial?
18. Why dark-colored clothes are preferable for winter?
19. Why moisture collects on the inside of a raincoat?
20. What things should be done in the care of clothing?
21. Why color should be considered when selecting clothes?
22. Why boys are often careless about their personal appearance?
23. That frequent airing prolongs the life of a garment?
24. When clothing may be a source of infection?
25. Why undergarments should be changed and laundered frequently?

Courtesy H. Armstrong Roberts

HAVING suitable clothes for all kinds of weather is the requirement of every modern girl. This not only gives personal satisfaction but is important for comfort and health.

Why we wear clothes. Human beings began wearing clothes in order to protect their bodies against weather and injury. The use of clothing for decoration came very early in the history of the human race. Often we forget that clothes are primarily protective and consider them only as decorative.

From the health standpoint, the chief function of clothing may be regarded as a protective covering. It helps to maintain a constant temperature; it shields from extreme heat of the sun and from cold and the piercing winds; it protects the skin from dirt and injuries. In addition to this, however, clothes must be attractive enough to give one a feeling of reasonable pride in them.

Clothing and body comfort. Clothing keeps the body warm by preventing the natural body heat from being too quickly conducted or radiated from the body. The warmth of a garment is determined by the type of fiber of which it is made and by the nature of the weave. Fur and wool make warm garments because they are poor conductors of heat and so favor the retention of the natural body heat. Substances such as cotton and linen, which easily conduct heat from the body, make cool garments.

Woolen fibers are rough and round. When they are woven into cloth, air is enclosed within the meshes and within the thread itself. On the other hand, cotton and linen fibers are smooth and flat. They pack more tightly and do not retain air so readily. Because of the difference in the weave of fabrics, woolen fibers may be so woven as to reduce their warmth, while cotton and silk may be so woven as to increase their warmth. Nylon and other synthetic fibers do not absorb moisture. This hinders evaporation from the skin so that these fabrics feel very warm.

One should wear the amount of clothing suitable to the temperatures in which he is living. Wearing too few clothes may cause chilling; and too many clothes may cause the skin to become overheated or keep it moist because evaporation of perspiration is difficult. On the other hand, excessive exposure of the skin to direct sunlight, especially in young children, is often uncomfortable and even dangerous. If the temperature is over 86° F., the skin is cooler with a loose layer of clothing than if bare.

In cool weather a person who is not physically active needs warm clothing to conserve the body heat. Energetic, active persons produce more heat and so require less clothing to keep warm, especially during physical activity. A good rule is to eat, exercise, and wear enough, but not too much.

Another important requirement for hygienic clothing is that it shall absorb perspiration but not dry too quickly. Too rapid evaporation of moisture may leave the skin chilled. Linen is a cool fabric because it absorbs moisture readily and gives it up quickly by evaporation. This evaporation uses up heat and makes the skin feel cool. But this effect depends also upon the amount of moisture in the air, so that when the air is both hot and moist, little water can be evaporated and no kind of clothing feels cool to the body. Rubber is not porous and so prevents the normal evaporation of moisture from the skin. Raincoats and rubbers should be removed when not actually needed.

Courtesy Wide World

EVEN LARGE CITIES are at the mercy of the elements. Proper warm clothing is needed to withstand the icy winds of winter.

Dark colors are warmer than light colors because they absorb more and reflect fewer of the sun's heat rays. A difference of as much as five degrees may be observed according to whether thermometers in contact with the skin are covered with white or black clothes. Winter clothes are usually dark, while summer clothes are preferably light in color.

Selecting clothes. In selecting material for warmth, one should consider the ease with which heat will be conducted through it, water evaporates from it, or air currents pass through it.

If one is indoors most of the time, the underwear should be suited to indoor temperatures, and additional outer garments should be worn for protection when going outdoors.

Damp clothing is harmful, especially in cool weather, because it conducts heat rapidly away from the body and leaves the body chilled. Such chilling makes the body more liable to colds, bronchitis, pneumonia, and digestive disturbances. One should avoid cooling off too quickly after exercise. The body should be protected by clothing so that rapid evaporation will not cause chilling of the skin and internal organs. This explains the usefulness of the sweat shirt as an extra outer covering.

In very hot climates clothing is worn to protect the body from the extreme heat of the sun's rays. While the popular sun suits may have much in their favor, their indiscriminate, and sometimes careless, use may result in much harm to sensitive skins from overexposure.

Comfortable clothes. To be healthful, clothing should usually be comfortable. No garment should be so tight as to disturb the circulation of blood or the action of the respiratory system. In winter, tight clothing may make one feel cold by interfering with the circulation of the blood; in summer, tight clothing will prevent the circulation of the air next to the skin and so make one feel warm.

Clothes should be loose enough to allow freedom of bodily movements. Sudden motions should not result in ripping of seams, breaking of straps, or popping off of buttons. As a whole, clothing should be so comfortable that we may forget it and give our attention to other things.

Appropriate clothes. We should select clothing to meet our needs. We shall be more comfortable physically and mentally if the clothes are suited to us and to the occasions for which we are wearing them. We should learn which styles, colors, and materials are most suitable and becoming and select from them.

Clothing which is out of place makes one feel conspicuous and usually shows poor taste. Hiking clothes are not appropriate in church. Neither have party dresses and high-heeled shoes a place on picnics or at school. For outdoor activities, such as hiking or mountain climbing, suitable shoes and stockings are necessary. Preparation should be made for adequate clothing to meet sudden changes of weather.

In equally poor taste is the adjustment of clothing in public. Constantly hitching up the belt, adjusting the shirt or the tie, and pulling up the shoulder straps are not habits of the well-groomed individual.

Styles help to create illusions as to size or build. The feeling that clothes are a part of, and not just on, oneself helps to create the self-confidence that is necessary for mental ease. Custom has set up standards of dress for various occasions, and it is advisable to learn what these standards are. In general, young people need different clothes for three types of occasions: for school, for active sports, and for "dress-up" or more formal affairs.

Attention, boys! The fact that you are a boy is no reason why you should skip this section on clothes. Are you the kind of boy who thinks that any old thing is good enough to wear to school and that "dressing up" is "sissy"? Some boys wear cords or jeans and shirts because that is what other boys wear. No one cares to be different from his friends if he knows that they will disapprove. However, it is foolish not to have independent ideas about neatness and care in personal appearance. If you wear trim-looking clothes to school and then put on somewhat better ones for dress occasions, others will have a tendency to do so too. Neatness in personal appearance is important in leaving the right impression on other people.

Courtesy H. Armstrong Roberts

THIS OUTFIT is appropriate for life on a ranch but is decidedly out of place on a city street.

For girls. The girl's problem of dress is more complicated. Neatness is again an important factor, but variety, good taste, and becoming lines are also necessary.

To develop good taste, you should know what kind of clothes are suited to the season, locality, time of day, and occasion, and you should choose clothes that enhance your personality.

Choosing the right color. Colors especially give opportunity to express personality. The three physical characteristics which influence choice of color in clothes are the color of the skin, of the hair, and of the eyes.

Eyes that are blue, green, or gray respond well to the cool shades in dress—blue, green, and violet. Dark, hazel, or brown eyes are attractive with the warmer colors—red, brown, rust, and yellow.

If the hair is the best feature, it may be well to accent it by contrast or repetition in the color of the dress. Lighter values in dress colors may accent blond hair by repeating its fairness. Values in black, brown, and auburn hair have as many variations as in blond hair.

The tone of the skin in the face and neck is probably the most important factor in choosing color because of the nearness to the visible skin of the material of the costume. Every skin has a certain amount of pink or yellow in it. If ruddiness is too evident, colors should be chosen to tone down the pink. On the other hand, certain colors may be used to bring out the pink in the skin.

Girls who have poor complexions because of poor health, inadequate care, or wrong eating habits may find it difficult to select appropriate colors. For these girls; medium values that do not emphasize the skin will appear more attractive than intense colors. In general, plain colors are more becoming than figured prints. It is difficult to formulate any set of rules for the wearing of colors, because each individual has different coloring of hair, eyes, and skin to consider in selecting clothes.

Personality plays a part in the choice of color in clothes. The vivid, dramatic person can wear strong colors. The person who is inclined by nature to be pale in coloring should not choose brilliant colors; they tend to subdue the individual even more. Drab and colorless clothes have the same effect. Soft, subtle shades, with stronger colors used only in small articles, such as accessories, should be chosen. A restful charm lies in the quiet, more subdued shades that do not absorb the color of the individual.

If the newest and smartest shades are not one's type, becomingness should not be sacrificed to fashion. Such colors may be used in the accessories or trimming. An entire costume in any color that is not friendly should be avoided.

White or bright colors appear to increase size, while dark or soft shades have the opposite effect. Fabrics also enter into color choice. What is becoming in soft crepe may be unbecoming in a shiny satin of the same color.

Hygienic clothing. Clothing serves an important function in protecting the skin from dirt and injury. Parts of the body which are not covered by clothing are soiled more easily, and more often cut or scratched. Nevertheless, if the clothing itself is not clean, it may be a source of infection.

The skin is constantly throwing off waste products which soil the garments next to it. All garments worn next to the skin should be made of materials which are washable. These should be changed frequently. The waste products in perspiration act upon silk; therefore, silk hosiery will wear longer if washed after each wearing. Body oils and perspiration soil garments because they catch and hold dust particles. Wool and silk dresses, because of their nature, are not cleaned so often as cotton and linen. Yet they often become very much soiled from perspiration. Wearing proper undergarments helps to prevent this soiling.

Clothing worn during the day should be hung so as to air at night. Different clothes should be worn for sleeping. It is unhygienic to sleep in the garments which have been worn during the day.

Caring for clothes. Selection and care make clothes last longer. Clothes should be made of materials that will wear well. Dresses that can be laundered are more economical than those that need to be dry-cleaned. Home dry-cleaning of suits or dresses is dangerous because of the possibility of explosions. Spots should be removed by a nonexplosive and noninflammable cleaner.

Dresses, coats, and suits should be placed on hangers so that they may air. Thorough brushing and airing of clothing out-of-doors not only is healthful but increases the life of a garment. All small rips or tears should be mended, and buttons should be sewed on securely. Pressing clothes is an aid to good grooming.

When shoes are taken off, shoe trees should be placed in them so that they will air and dry in shape. Stockings and socks should be washed after each wearing and kept neatly mended.

A soiled handkerchief is not only unhealthful to use, but is decidedly unpleasant to others. Cleansing tissues, which can be destroyed after use, are being more generally adopted every day as a substitute for handkerchiefs.

Fads in clothes. Students often start fads in clothing. The wearing of old, mutilated hats by boys, charm bracelets by girls, and autographed jackets by both are examples. But they should not be worn if they detract from personal appearance and savor of vulgarity. Most fads are of short duration and exist for a time because some persons like to call attention to themselves. Soiled sweat shirts and jackets with vulgar slogans do not make favorable impressions on those whose opinion is worth while.

Clothes as an aid to personality. We often reveal our personalities by our clothing. We may wish to be admired and respected by others, or we may select our clothes purely for our own satisfaction. A person with an inferiority complex may select the thing that everyone else is wearing, whether it is becoming to him or not, because he fears to be different. On the other hand, clothes that are well chosen but different give individual distinction and help to overcome the feeling of inferiority. Clothes may help us to present a pleasing appearance to others and to satisfy our own mental needs. The well-adjusted individual will use clothes chiefly as an aid to physical and mental health, although with due regard to appearances.

In conclusion

CLOTHES are suitable if they are adapted to the occupation and surroundings of the individual and are conducive to his best physical and mental development. They should be comfortable, hygienic, and attractive. Each person should take care to choose clothes with becoming styles, lines, and colors. Then the assurance that comes from knowing that one is correctly attired gives the background for a pleasing personality.

Activities

1. Examine under the microscope threads taken from pure cotton, silk, linen, and woolen cloth. Which fiber is the roughest? Which, the smoothest? Which fiber would make cloth with meshes that would hold the most air? Which cloth makes the best summer garment? The best winter garment?

2. Determine what kind of cloth holds heat best. Lay three small pieces of goods—silk, cotton, and wool—of the same weight or thickness on a very warm surface, such as the bottom of a flatiron or the top of a radiator. Then place your hand so that a finger rests on each of the three pieces. Which kind of material lets most heat pass through it? Which would be best to wear in cold weather?

3. Do all persons require the same amount of protective covering? What standards should govern the selection of clothing for summer? For winter? For indoors? For outdoors?

4. In purchasing clothes, should you pay for style or serviceability?

5. Why are woolen garments equally comfortable in extreme heat or in extreme cold?

Test

Directions: The items of this test are statements which have been discussed in the previous chapters and which can be classified under the headings **A, B, C, D,** and **E.** Make five columns on a separate sheet of paper headed A, B, C, D, and E, and write the number of each statement in the list which follows under the proper column. Do not write in the book.

A, statements of well-established facts which are always true

B, statements of well-established theories which are generally accepted by authorities

C, statements of theories which are questioned by some authorities

D, statements of popular beliefs, not supported by evidence

E, statements about which you do not know enough to classify them

1. The chemical action of sunlight is beneficial to the body.
2. Cutting the ends of the hair causes the hair to grow faster.
3. Iron is a good conductor of heat.
4. Decay is the result of bacterial action.
5. The image produced on the retina of the eye is upside down.
6. Warts develop from the handling of frogs.
7. Baldness is hereditary in men.

8. Trachoma is a virus disease.
9. A square jaw indicates a strong will.
10. Freckles are pigment spots in the skin.
11. The lens of the eye becomes more rigid as one grows older.
12. A high forehead indicates high intelligence.
13. Dark colors absorb more heat rays than light colors.
14. A clean tooth will not decay.
15. Evaporation of liquids produces a cooling effect.

Associated subjects

Biology: The fact that body temperature is controlled through oxidation of food, circulation of the blood, and by evaporation and conduction of heat from the body. . . . The types of protective covering of various animals.

Home economics: Clothing materials, the creation and selection of styles, and the care of clothing. . . . The choice of clothing for individual needs, for special occasion, according to ability to buy. . . . The proper clothes for younger children.

Physical education: Importance of clothing that allows freedom of movement for correct posture. . . . Necessity for wearing loose clothing for exercise. . . . Protection of the body from chilling after vigorous exercise. . . . Adaptation of correct clothing to different athletic activities. . . . Importance of clean clothing which comes in contact with the skin.

Physics: The use of heat as a form of energy. . . . The transmission of heat through, and its absorption by, various substances. . . . The loss of heat from surfaces through conduction, radiation, and evaporation of liquids.

References

ALLEN and BRIGGS. *Behave Yourself!*
BAXTER and LATZKE. *Today's Clothing.*
BURNHAM, JONES, and REDFORD. *Boys Will Be Men.*
HAWES. *Good Grooming.*
STEPHENSON and MILLETT. *As Others Like You.*
VAN DUZER. *The Girl's Daily Life.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Film

Body Care and Grooming. 17 minutes, sound. McGraw-Hill.

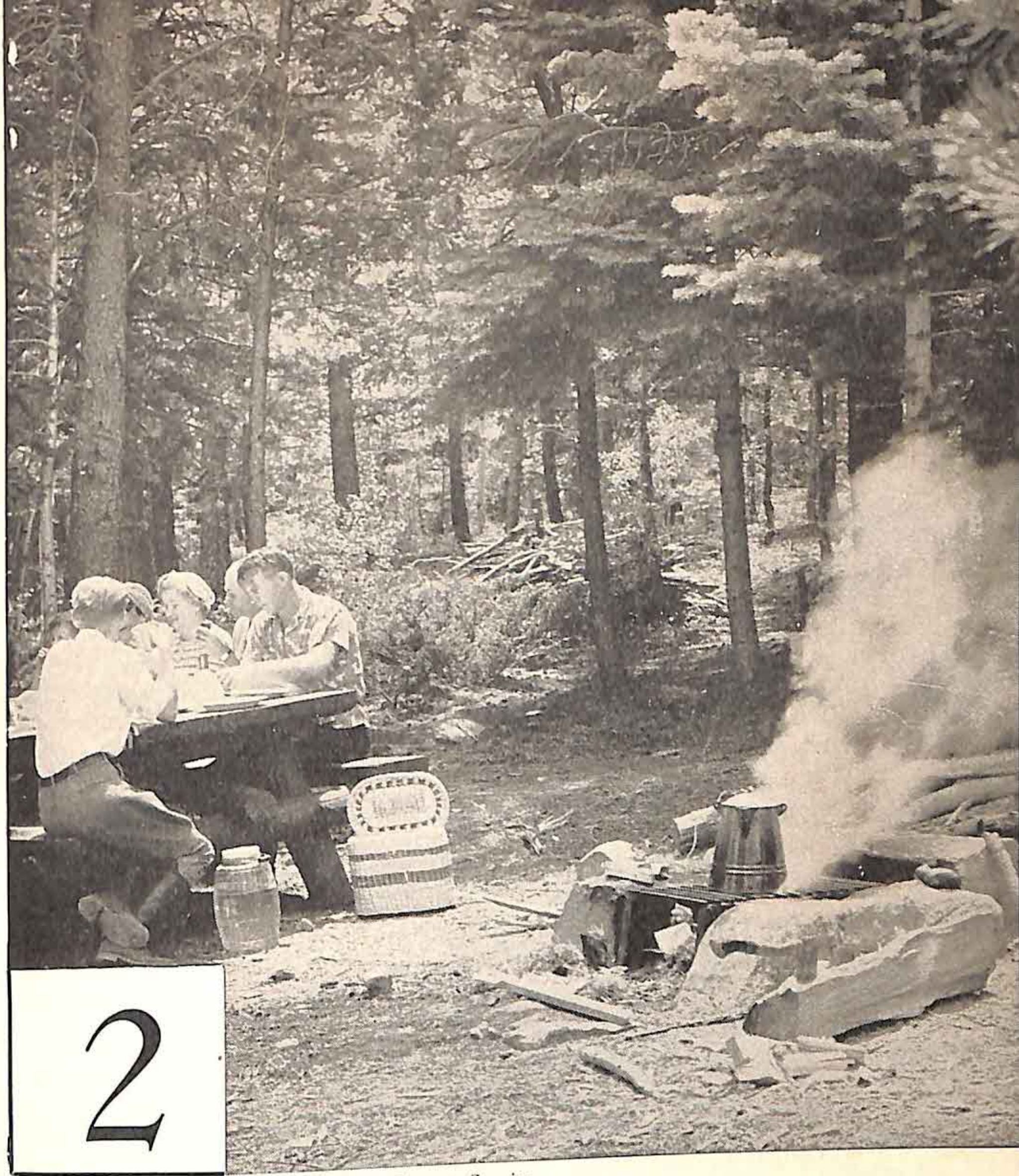


Photo by U. S. Forest Service

2

Your Health and Well-Being

12. *FOODS SERVE THREE MAIN PURPOSES*

EVERY normal boy and girl wants a body that is strong, healthy, and good-looking. We are fortunate to live in an age when science has done much to make it possible for us to develop such bodies by selection of the right foods for our needs.

How much responsibility rests on you for the food you eat? Perhaps you do not actually prepare the food served to you daily, but you often choose what you eat. It is for you to decide whether you will drink milk or coffee, eat fruits and vegetables, accept good foods or poor ones.

Do you know . . .

1. Why we eat?
2. How much food and what kind a high school pupil needs daily?
3. How many calories a high school pupil needs?
4. Whether a football player needs foods different from other boys and girls or just more food?
5. Why the calorie is no longer regarded as the most important factor in determining diet?
6. Why the food we eat should always contain mineral salts?
7. Why vitamins are important?
8. Why vitamin D is called the sunshine vitamin?
9. Which vitamins must be supplied daily in the diet to insure health?
10. If the food selection that contains the necessary calories provides all the requirements of the body?
11. What is meant by an adequate diet?
12. Why milk is a good food?
13. Whether it matters what kind of food we eat if we get enough to satisfy hunger?
14. If a so-called "vegetarian diet" is healthful?
15. Why it is safer to have all milk pasteurized?
16. How much water one should drink a day?
17. Why the use of dehydrated foods has increased?
18. How to select alternate foods?

You and your food. The difference between what you are and what you would like to be may largely be a matter of the kinds of food you are eating. Foods are body-building materials, and the kind of body one has depends mainly on the kind of food eaten. The building contractor who does not investigate kinds and purposes of materials, and how they will stand up against wind and weather, is not very farsighted. He cannot build a house of brick alone. He must also use other substances, such as glass, steel, and wood. He must know how to select the best materials for walls, floors, and windows. Concerning these living houses which we are building, should we not be equally careful and well informed?

Chemical make-up of the body. The human body is made up of a number of chemical elements held together in many different forms or chemical combinations. They are found as follows:

In appreciable quantities:

- Oxygen
- Carbon
- Hydrogen
- Nitrogen
- Calcium
- Phosphorus
- Potassium
- Sulphur
- Sodium
- Chlorine
- Magnesium
- Iron

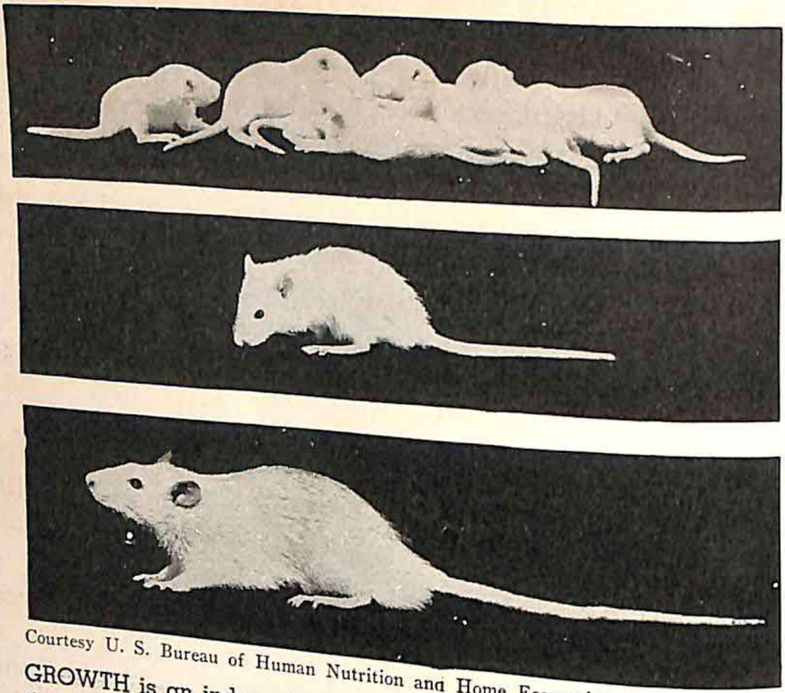
In minute quantities:

- Iodine
- Fluorine
- Manganese
- Silicon

Mere traces of other elements.

Each of these elements is essential to the construction of the body, and each has a special function to perform in the body machine. The human body is a very complex combination of these elements. Expressed in compounds, the body is approximately 71 percent water, 18 percent protein, 7 percent mineral matter, 3 percent fat, and 1 percent carbohydrate.

The purposes of food. Foods have three main functions in our bodies—as energy producers, body builders, and regulators of the



Courtesy U. S. Bureau of Human Nutrition and Home Economics

GROWTH is an index of nutrition. White rats are used for nutrition studies because they grow rapidly, mature early, eat the same kinds of food we do, and show the same effects of good and bad diet. The litter of rats at the top are only two weeks old and weigh 22 grams each. The rat in the center is four weeks old and weighs 47 grams. The mature rat (twelve weeks old) at the bottom weighs 193 grams.

body processes. Some foods serve only one purpose in the body. For the most part, however, the three functions are not isolated; they are interrelated and in many ways dependent upon one another.

The body is made of chemical substances which are constantly being used up. Food can replace these substances, and it is our business to see that our foods contain them.

The most insistent demand of the body is for fuel to keep the body warm and to be converted into energy. Food actually burns by uniting with the oxygen in the cells of the body. Energy is made available and heat is produced. This energy permits such involuntary activities as breathing and the beating of the heart, and makes possible our participation in such activities as walking, strenuous games, or hard physical labor.

Nutrition. The science of nourishing the body properly is known as *nutrition*. Good nutrition includes sufficient food for growth, for maintenance, and for repair of the body as a whole. Adequate nutrition insures a fairly satisfactory condition of health. A diet that is inadequate may be the cause of poor health, nervous instability, an irritable disposition, and lack of energy and vitality.

No one food is perfect in that it meets all the requirements of good nutrition. Two foods which come the nearest to such perfection are whole milk and whole grain cereals.

Energy metabolism. Metabolism is a term used to designate the chemical changes which take place in the living cells of the body. Through chemical changes, food material is converted into living substance (protoplasm), and thus the body grows in size, and worn parts are repaired. Through chemical changes, food is burned and energy is produced. This is always accompanied by heat, so heat becomes a measure of energy metabolism.

The *calorie* has long been used as the measure of heat. In the science of nutrition the calorie is the amount of heat necessary to raise the temperature of one kilogram (about 1 quart or 2 pounds) of water one degree centigrade or of one pint (1 pound) of water four degrees Fahrenheit. The calorie measures only the energy value of food, just as the yard measures the length of cloth, or the pound measures the weight of sugar. In order that the amount of heat liberated may be determined, food samples are placed in an apparatus called a *calorimeter*. The food is burned in pure oxygen in a gas-tight chamber or "bomb," and the heat is taken up by water surrounding the bomb. The change in the temperature of the water shows the amount of heat liberated. For example, if we have one kilogram of water and burn a given food that raises the temperature of the water 1° C., that amount of food furnishes one calorie; if it raises the temperature 100° C., we say that amount of food is 100 calories.

In a similar way experiments have determined the amount of heat produced by each type of food as it is burned in the body.

Tables of 100-calorie portions of food have been compiled to serve as guides to those persons interested in determining the number of calories obtained from various foods. As to many foods, it happens that the 100-calorie portion is about an average serving.

Caloric requirements. Careful scientific experiments have measured the quantity of heat used by the body during various types of activity, as shown in the table below. These amounts depend upon the age of the individual, his size and weight, as well as the kind of work he does.

A child's body cells work at a more rapid rate than those of an adult. In relation to his size, he actually needs more calories. A boy four years old who weighs thirty-six pounds needs about 1,500 calories a day; while his father, thirty years old who weighs 154 pounds, needs about 3,000 calories. The boy is one-fourth his father's weight but needs one-half as many calories.

A moderately active person uses about half the energy he gets from food just for staying alive—keeping the body at normal heat

Caloric Requirements for Various Activities [1]

ACTIVITY	CALORIES NEEDED PER HOUR PER POUND OF BODY WEIGHT
Sleeping	0.42
Sitting at rest	0.65
Very light exercise (Ordinary walking)	0.88
Light exercise (Involving few muscles, as typewriting)	1.10
Moderate exercise (Gym and sports after school)	1.88
Severe exercise (Involving many muscles, as sawing wood)	2.92
Very severe exercise (Running at the rate of 5 miles per hour)	3.90

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[1] From Mary Swartz Rose, *The Foundations of Nutrition*. By permission of The Macmillan Company, publishers.

and the internal organs going. This minimum use of energy by the body for maintenance is called the *basal metabolism*. Any physical movement, however slight, demands an additional use of energy over that involved in basal metabolism. Food absorbed beyond the amount required for basal metabolism and current activity is chiefly stored as fat.

One gram of pure carbohydrate furnishes approximately 4 calories.

One gram of pure protein furnishes approximately 4 calories.

One gram of pure fat furnishes approximately 9 calories.

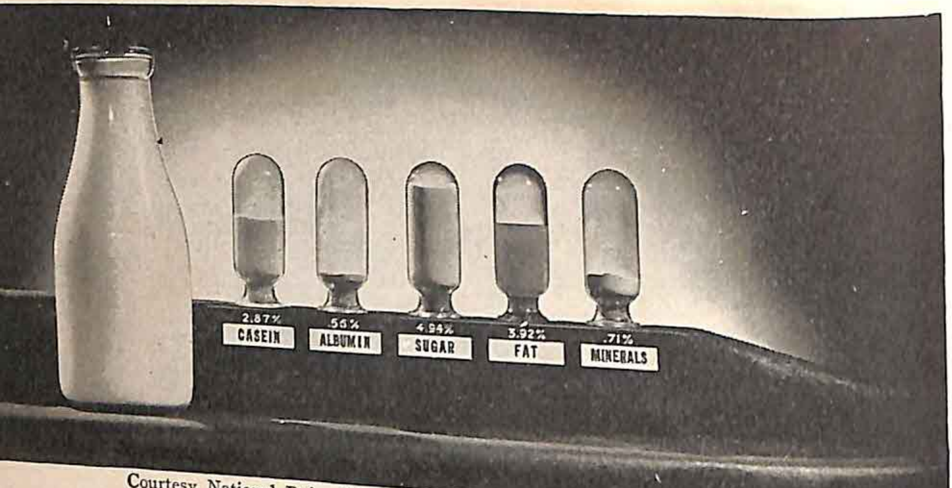
(One-quarter teaspoonful weighs approximately 1 gram.)

Fats are a more concentrated form of bodily fuel, and furnish two and one-fourth times as much energy as the carbohydates and the proteins.

Courtesy U. S. Bureau of Human Nutrition and Home Economics

FOODS are analyzed and the results evaluated and compiled in the laboratory. On the basis of these figures concerning the protein, fat, carbohydrate, and mineral content, diets can be scientifically planned.

Food for energy. Foods which supply energy and keep the body warm are carbohydrates (starches and sugars), fats, and proteins. Carbohydrates are most readily used. Fat is the most concentrated fuel. When carbohydrates and fats are available, energy is not derived from protein. If more fuel food is taken in than the body needs, the surplus is stored as glycogen or as fat. An overweight person who wants to reduce should limit his starch, sugar, and fat intake.



Courtesy National Dairy Council

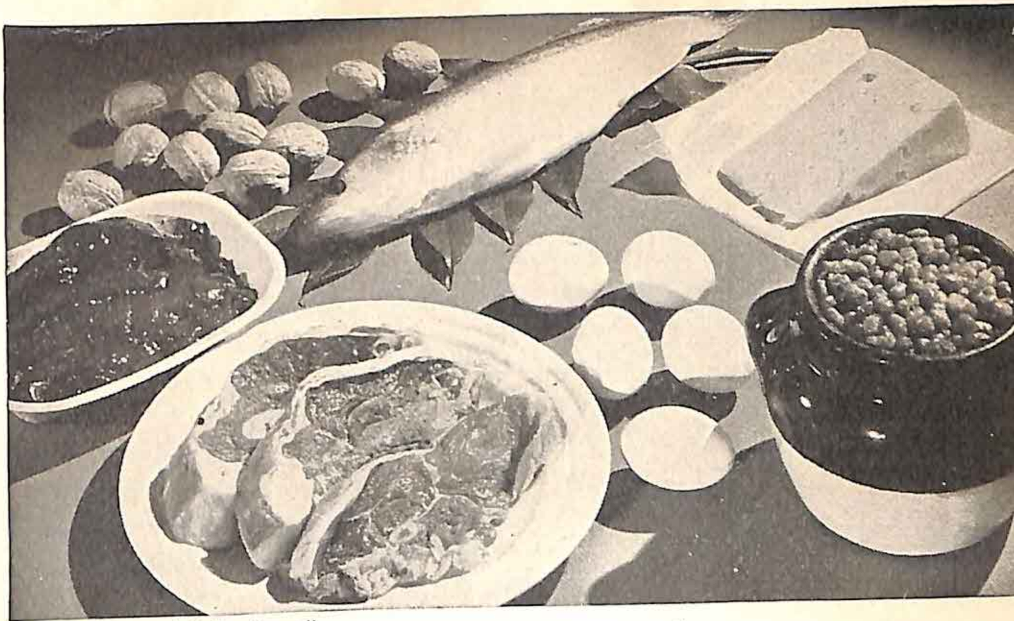
THERE IS more sugar than fat in a quart of milk, a great deal of casein, some minerals, and a small amount of albumin.

It must be remembered that the fuel value of food is only one indication of its nutritive value. Certain types of fat are essential parts of the tissue of the body, and they also carry the fat-soluble vitamins A, D, E, and K.

Many foods contain starches and sugars. Cereals, potatoes, breads of all kinds, peas, and beans are good sources of starch. Sugars, sirups, and honey consist chiefly of sugar. Candy, cake, sweet desserts, and fruit contain large amounts of sugar. Whole milk is about 5 percent sugar.

In equal amounts, fats will produce two and a quarter times as much heat as starches and sugars. In warm or temperate climates we are not so likely to eat of them in quantities large enough to allow for much storage. Butter, cream, milk, fatty meats, salad oils, cheese, and nuts are excellent sources of fat.

Food for tissue-building. The second way in which the body utilizes food is in building new tissues and in replacing those which need repair. The body does not acquire its full growth until about the age of twenty-five years, so that adequate material for growth is needed until that age. All through life, worn-out tissues must be replaced. The living material (protoplasm) of the



Courtesy National Dairy Council

THESE FOODS are good protein foods for building muscles and all tissues.

cells that make up tissues requires nitrogen and such minerals as sulphur and phosphorus.

All proteins contain carbon, hydrogen, oxygen, nitrogen, and sulphur in varying amounts. Some proteins also contain phosphorus and iron, and there are occasionally other elements. Protein is therefore the only foodstuff which can supply these elements and thus meet adequately the needs of growth and repair.

Protein is not stored in the body as starch and sugar are. Any excess is thrown off as waste material. The nitrogen which protein contains is excreted through the kidneys.

Proteins will furnish fuel, as starch, sugar, and fat do, but protein is expensive food material. It is poor economy to use it to supply energy. As a building material it has no substitute. The name protein comes from the Greek, meaning, "I am first."

Amino acids. There are many kinds of protein, all of which are made up of the simpler substances known as *amino acids*. The value of a protein in nutrition depends largely upon the amino acids present. At least twenty-two of these acids are now known, and others may be discovered in the future. As the letters of the alphabet combine to form words, these amino acids combine to form different proteins. As words are grouped to form sentences, the proteins combine to form living tissues. Some of the amino acids are manufactured by the body, but there are at least ten that must be obtained from the food we eat.

No one food protein contains the entire number of amino acids. A variety of proteins in the diet is necessary to provide all the amino acids needed by the human body. The proteins which contain all of the amino acids necessary to maintain life and to promote growth are called complete proteins. Among the foods supplying complete proteins are milk, eggs, cheese, meat, fish, poultry, peanuts, and soybeans. These are especially necessary during the period of growth. Incomplete proteins are those which lack one or more of the necessary amino acids, and are therefore unable to maintain life or support growth. The proteins found in corn (or maize) and gelatin are in this group. The partially incomplete proteins are those which will maintain life, but will not support growth. They are found in wheat, rye, barley, peas, beans, and lentils. This does not mean that these foods should not be included in the diet. When used, they should be supplemented with some of the complete proteins from such foods as milk, eggs, or meat. It will be noted that the most abundant food materials containing complete proteins are of animal origin.

Food for regulating. Besides these foods for energy and building, the body needs special materials to carry on particular functions. There are four classes of substances which do this and are known as body regulators. They are mineral salts, vitamins, cellulose, and water.

Mineral salts. Mineral compounds have two important functions in the body—building and regulating. Traces of many mineral salts are found in the body, but only four of them need to be specially planned for in the diet. (See the table on p. 160.) If these are present, the others will be found in the same foods.

If foods are burned, an ash residue is frequently formed. In this ash are found the minerals which the foods contained, among which are *calcium* and *phosphorus*. They occur combined in the body as calcium phosphate. Bones and teeth require the greatest proportion of the salts of calcium and phosphorus.

At birth the bones of a baby are largely cartilage, a substance that bends easily but is tough and difficult to break. Cartilage is not rigid enough to hold the body upright, so the baby cannot walk until calcium phosphate has been deposited throughout the cartilage. A layer of cartilage persists at the joints where the bones come together. The bones of the child continue to grow in length as cartilage; then the cartilage is gradually replaced by calcium phosphate. The adult will have about two pounds of calcium and one pound of phosphorus in his body.

The human body contains more calcium than any other mineral element. Ninety-nine percent is in the bones and teeth and one percent circulates in the blood stream and permeates the soft tissues. Calcium seems to play an important part in the clotting of the blood when the latter is exposed to the air.

An insufficient supply of calcium may cause a stunting of the skeletal framework, as shown on page 201. A severe lack of vitamin D causes the disease known as *rickets* from a deficiency of the use of calcium by the body.

Phosphorus also plays an important part in the chemical reactions which utilize the energy of foods. Phosphorus and calcium are so closely associated that it is difficult to separate their functions in the body.

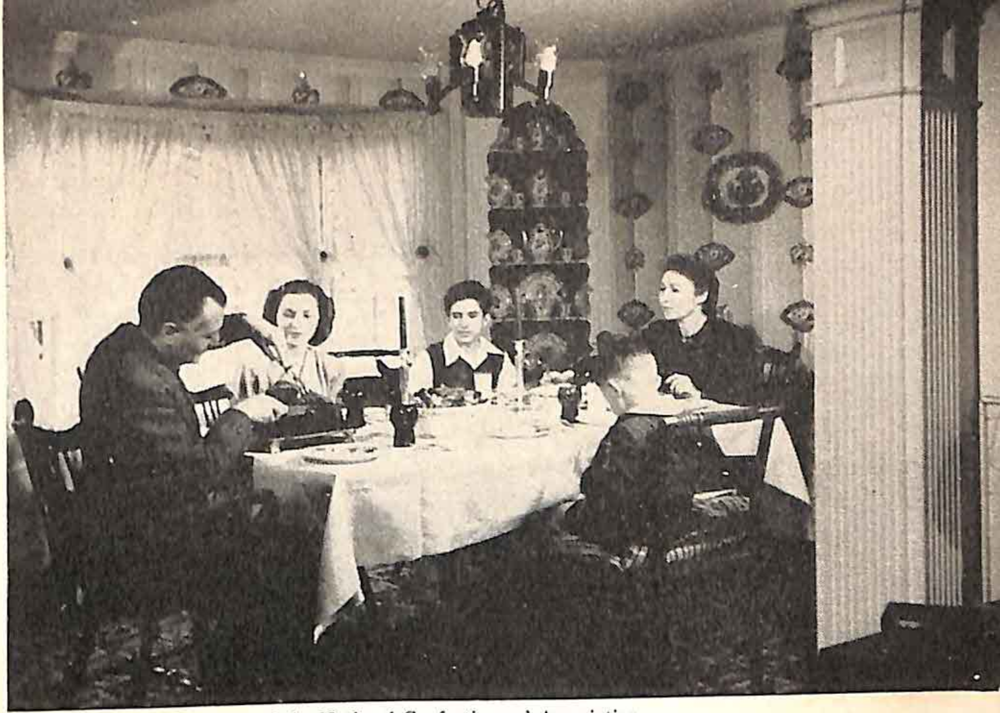
Iron is an important constituent of every cell of the body. Its daily requirement in man is about 0.006-0.01 gram. More than half of the iron in the body is in the hemoglobin, or coloring matter, of the red blood cells. Hemoglobin is an iron-protein compound which is responsible for carrying oxygen to the cells and stimulating cell activity. A trace of iron is in the soft tissues of the liver, bone marrow, and spleen, ready to be converted into hemoglobin when needed, and also takes part in the oxidation going on there. When too little iron is taken in the diet, not enough hemoglobin can be manufactured and the resulting disease is known as nutritional anemia (see p. 213). Copper is found with iron in foods. It must be present with iron to form hemoglobin.

Iodine salts, while only found in traces in the body, are very important in the production of the internal secretion of the thyroid gland. This secretion controls the rate at which food is burned to give energy. It affects storage of fat, and may even affect mentality. Lack of iodine may cause a diseased condition of the thyroid gland known as goiter (see p. 296). Because of an iodine deficiency in the soils in certain parts of the country, foods grown in those sections fail to supply even the small amount of iodine needed to prevent simple goiter. The use of iodized salt or the regular consumption of sea foods in the so-called "goiter-belt" supplies the iodine essential for the prevention of simple goiter.

Important Sources of Minerals

CALCIUM	PHOSPHORUS	IRON	IODINE
Milk	Milk	Liver	Sea foods
Cheese (American)	Navy beans	Navy beans	Vegetables, cereals, dairy products, and fruits produced on soils which are good in iodine content.
Cauliflower	Halibut	Mustard and turnip greens	
Cottage cheese	Liver	Spinach	
Turnip and mustard greens	Cheese (American)	Lean meat	
Navy beans	Oysters	Oysters	
Oranges	Beef, round	Egg (yolk)	
Parsnips	Salmon	Whole grains	
Oysters	Whole cereals	Apricots	
Egg (yolk)	Egg (yolk)	Prunes	
		Oranges	
		Raisins	
		Molasses	

Cellulose. Cellulose, which is present in the walls of all plant cells, is found in all plant foods. As bulk, it has a valuable regulating function, in that it stimulates peristaltic action of the intestinal muscles. Cellulose is similar in compositon to the starches and sugars, but in the human animal it cannot be burned to furnish energy. It passes through the digestive tract unchanged, carrying with it other food materials which have not been digested or have not been used by the body. Sluggish intestinal action may be



Courtesy Council on Candy of the National Confectioners' Association

FAMILY MEALTIME is important for the health and happiness of every member. Food that is served attractively will appeal to the appetite and will help persons to form the habit of having adequate, well-planned meals. Pleasant times at the table promote unhurried eating.

favored by the modern tendency to use too highly refined foods—soft foods from which the cellulose has been removed. The best sources of this roughage material are whole cereals, fruits, and vegetables. It is not found in animal products.

Water. While water is not commonly considered a food, because it does not build tissue or furnish fuel, it plays such a necessary part in normal nutrition that it should be considered with the foods. Cell-building cannot take place without the presence of water. Practically all body processes are dependent upon water. It controls body temperature; dissolves solid food substances; acts as the basis of all body fluids; and carries food materials through the body and waste products out of the body. Poisonous waste products may accumulate rapidly in the body unless plenty of water is taken daily. This amount varies in different individuals. The average diet supplies some liquid, and the water you drink when thirsty will probably supply you with the balance for your individual needs.

A normal man of average size loses about one and one-half pints of water a day as insensible perspiration—water vapor from the skin and about one pint from the lungs. Ten pints may be lost in an hour as sweat during hard exercise. From two to five pints a day are excreted by the kidneys and bowels. Suppose the average total loss under certain normal conditions is six pints every twenty-four hours. This will be partly replaced by about four pints taken in with a normal mixed diet, leaving about two pints, or four glasses, to be drunk as water. No general recommendations for drinking any specific amount of water every day can be made. Six to eight glasses of water may be considered a good daily average. Under normal conditions the water balance in the body is fairly constant because the sensation of thirst induces the individual to drink water.

Excessive sweating removes salt from the body rapidly. Taking extra salt to make up for this loss is now commonly advised for those carrying on hard work or exercise in great heat.

Vitamins. Vitamins play an extremely important part in the proper nourishment of the body, being essential for growth, health, and vigor at all ages. They regulate many body functions, promote growth, and serve as protection against certain deficiency diseases. The person who is always tired, lacks pep, catches cold easily, and is generally below par is frequently suffering from vitamin shortage.

Growth of knowledge of vitamins. Before 1900 it was known that certain amounts of protein, fat, carbohydrate, and minerals were necessary in a properly balanced diet. It was also known that to remain healthy a person must have a diet containing a variety of foods as well as fresh vegetables and fruits, even though these contained only relatively small amounts of what were considered the necessary nutrients.

In 1911 Casimir Funk, as a result of his investigations into the cause of beriberi, obtained from rice polishings a crystalline substance which was capable of preventing or curing this deficiency disease. He named the substance *vitamine* in view of its quite

Courtesy Florida Citrus Commission

ORANGE JUICE is a favorite drink of most people. Orange, grapefruit, or tomato should be eaten daily to secure enough vitamin C.

evident importance to life and its apparent relation to the amines or organic bases. Later the *e* was dropped from the word because of its wrong significance. Since that time a number of substances which play a similar important part in nutrition have been discovered. The individual vitamins were originally designated by letters of the alphabet; now, we often use descriptive names also.

In the days of long sea voyages, scurvy occurred frequently among the sailors. In this disease the tiny blood vessels break down, causing bleeding and sometimes death. It was found that sucking the juice of lemons protected the sailor against this disease. Limes, stronger in acid, proved even more effective. Thus it became a general custom to dole out lemons first and limes later to the sailors with their ration of salt meat. From this custom the ships were known as "lime juicers" and the sailors as "limeys."

For centuries a disease called beriberi has prevailed among the rice-eating people of Japan, China, and the Philippine Islands. These people lived on a diet composed entirely of polished rice and fish. Beriberi, which affects the nervous system, can be cured by eating a varied diet or by adding rice bran.

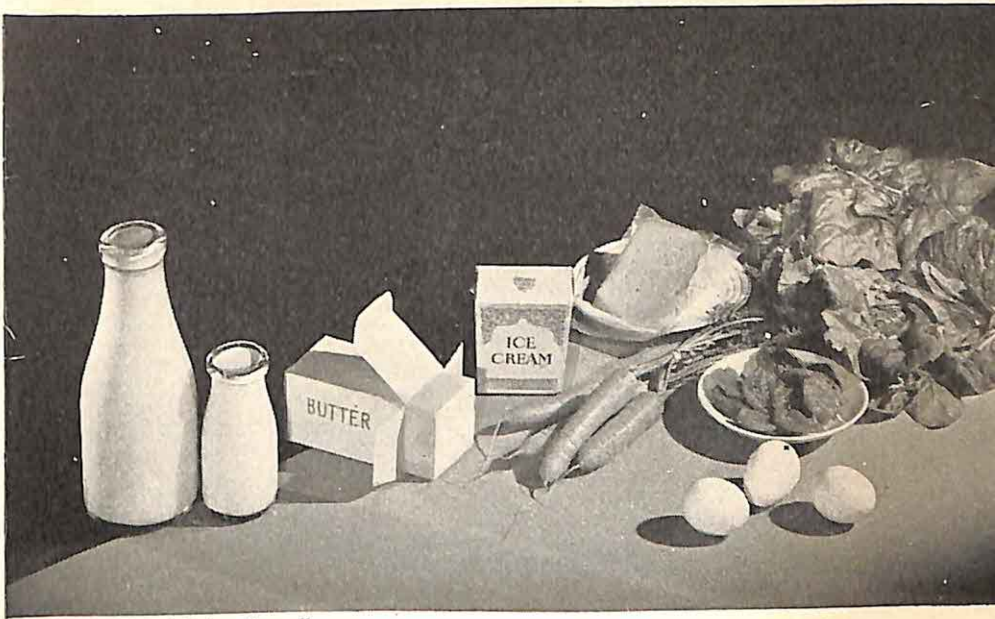
Our knowledge concerning vitamins has grown rapidly since the beginning of the century. At first, vitamins were known only by the response to them of certain animals in feeding experiments. At the present time several of the vitamins have been isolated and their chemical compositions are known.

It is possible to determine the amounts of vitamins in foods. The quantities are expressed in vitamin units, just as distance is expressed in feet and miles (see p. 174). Many foods have been so tested, and tables of these vitamin units help in selecting foods to assure an abundant quantity of vitamins in the diet.

Vitamin A. This is necessary to the health of all mucous tissues, including the linings of the eyes, the nose and other organs of respiration, the alimentary canal, and the urinary tract. Vitamin-A deficiency thus implies weakening of one of the defenses against bacterial infection. It also causes the skin to become dry and the nerve endings to be inflamed. Deficiency in vitamin A sometimes results in *night-blindness*. Persons afflicted with this form of blindness are unable to see well in dim light, especially after they have been exposed to strong light. It should be remembered that the visual purple in the eye, without which one cannot see, is bleached out white in bright light. If enough vitamin A has been supplied in the diet, the visual purple is regenerated quickly.

In severe cases of this type of night-blindness, the vision does not return to normal until a sufficient amount of vitamin A has been given to the individual. It has been suggested that this impairment of vision is a contributing factor in some motor accidents occurring at night. Apparatus for detecting vitamin-A deficiency has been devised, but as yet it is not entirely satisfactory. In times of severe food shortage there is danger of frequent occurrence of an eye disease known as *xerophthalmia* which will lead to blindness if it is unchecked.

Vitamin A is one of the few vitamins that can be stored in the liver and the kidneys through the daily use of foods rich in this vitamin. Vitamin A is rather widely distributed among the foods we ordinarily eat, being found in the fats of milk, eggs, livers, and fish. This vitamin is particularly abundant in the liver oils of



Foods Rich in Vitamin A

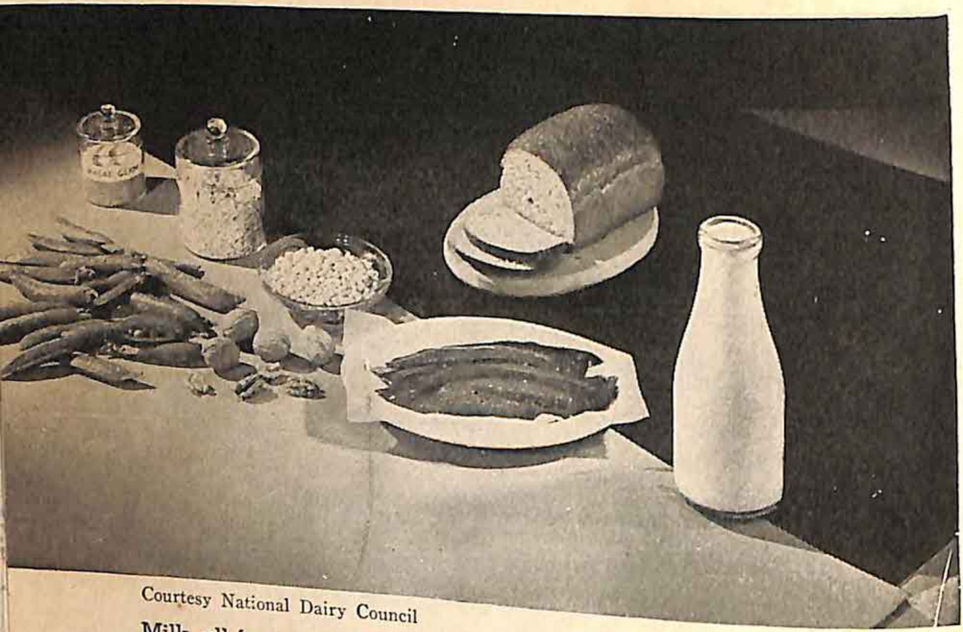
Courtesy National Dairy Council

Butter and cream
Whole milk
Cheese made from whole milk
Eggs
Green and yellow vegetables
Apricots

such fish as cod and halibut. In yellow and green vegetables there is a yellow substance known as *carotene,* which is a precursor of vitamin A. This is converted in the body, chiefly in the liver, into the vitamin. Since it is only fat-soluble, very little vitamin A dissolves in the cooking water.

Vitamin-B complex. In the beginning of the history of vitamins, *vitamin B* was thought of as a single factor. Later investigations showed it to be a combination of several vitamins. The following have been made artificially (synthesized) and the chemical compositions have been established for most of them: B_1, or thiamin; B_2, or riboflavin; nicotinic acid (niacin), or the pellagra-preventing factor; B_6, or pyridoxin; and pantothenic acid. There are other vitamins about which information is still incomplete. When there is a deficiency in any one of the B vitamins, there will probably be a deficiency in some other vitamin. Vitamin-B

Good Sources of Vitamin B_1 (Thiamin)



Courtesy National Dairy Council

Milk, all forms
Whole grains
Oatmeal
Walnuts
Beans, peas, and other legumes
Whole wheat bread
Liver and other edible organs
Wheat germ

deficiency often occurs among those in the low-income group, those with faulty dietary habits, alcoholics, and persons with diseases affecting the vitamin-B requirement.

Vitamin B_1 (thiamin). This is essential to growth and very important in maintaining a normal appetite. A deficiency reduces the muscle tone of the digestive tract and interferes with the functioning of the nervous system. Rats and pigeons soon manifest a characteristic disease of the nervous system known as polyneuritis when this vitamin is withheld from the diet. Partial vitamin-B_1 deficiency may cause digestive disorders, constipation, dyspepsia, and chronic fatigue. Vitamin B_1 also seems to assist in bringing about proper oxidation, especially in nervous tissues. This vitamin is of special importance to growing children and to pregnant and nursing women.

Vitamin B_1 cannot be stored in the body to any appreciable de-

Good Sources of Riboflavin (Vitamin B_2)

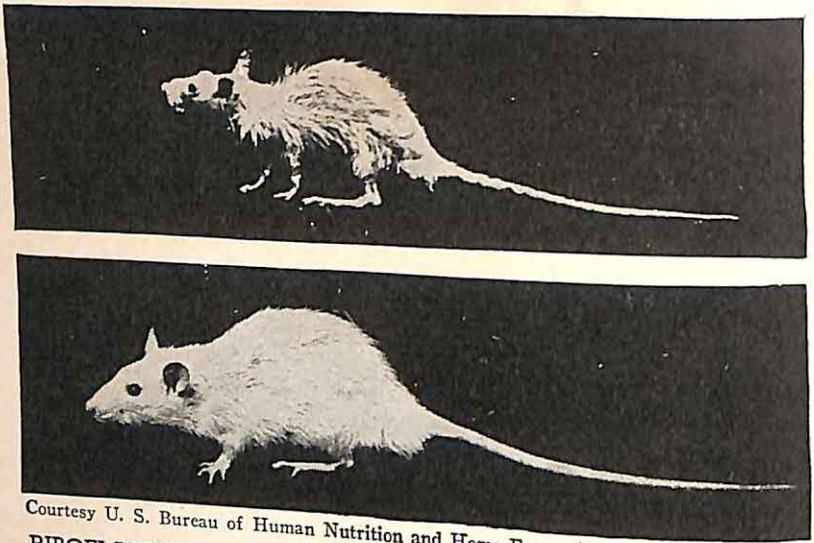
Courtesy National Dairy Council

Milk, all forms
Cheese
Eggs
Liver and other edible organs
Prunes
Green leaves
Fresh Lima beans

gree. It must be provided daily in the food we eat. Vitamin B_1 is found in the wheat germ, whole-wheat flour, peanut butter, lean meats, fowl, liver, whole milk, evaporated and dried milk, brewer's yeast, and fresh vegetables and fruits (including bananas).

One of the reasons given for the inadequacy of this vitamin in the American diet is the increased consumption of refined flours and cereals, sweets, and fats, all of which are very low in vitamin B_1. But as long as we select our food supply from a wide variety of food products, there is not much danger of beriberi in the United States.

To overcome thiamin deficiency, a process has recently been developed whereby the wheat germ and all the wheat kernel except the outside covering may be included in white flour. Bread made from this flour is much higher in vitamin-B_1 content than is that made from bleached white flour. Some bakers are now add-



Courtesy U. S. Bureau of Human Nutrition and Home Economics

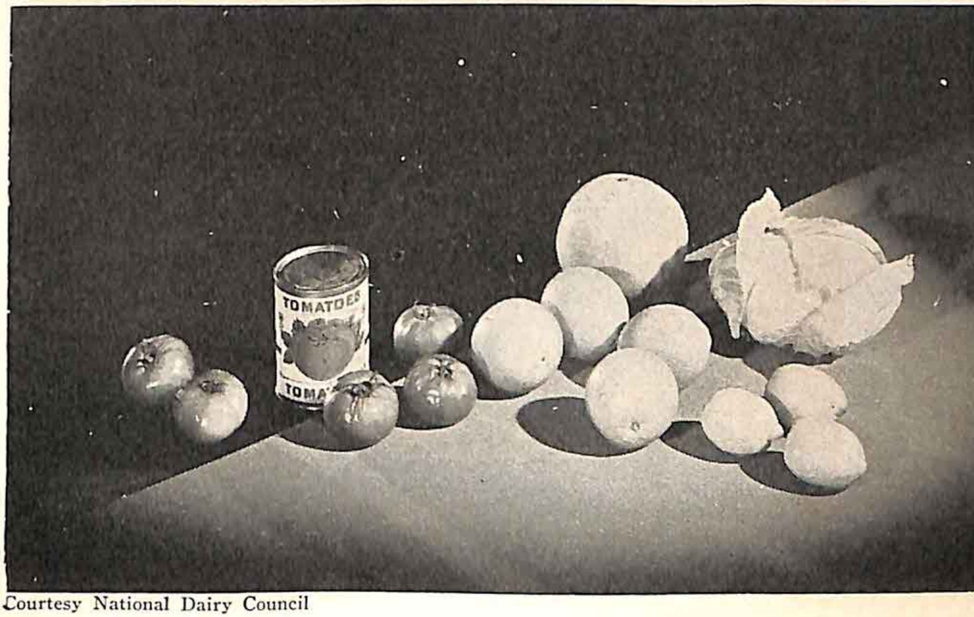
RIBOFLAVIN is necessary for general well-being. The rat at the top had no riboflavin and weighed only 63 grams. Note loss of hair and emaciated condition. At the bottom is the same rat six weeks later after having received food rich in riboflavin. Its weight had increased to 169 grams.

ing thiamin to white bread. For the same purpose many persons eat whole-wheat bread instead of white bread.

Vitamin B_2 or G (riboflavin). A deficiency of this vitamin is known to retard growth and to impair general health. It may also cause digestive disturbances and a loss of body weight. In certain animals a deficiency may result in loss of hair and in premature old age. Riboflavin was a part of the original vitamin-B complex. It is present in every living cell and aids in the oxidation of food materials for use in the body.

Nicotinic acid. This is the pellagra-preventive vitamin and is a substance of particular significance in areas where pellagra is most prevalent, as among the cotton-mill workers of the South. However, pellagra may occur in any locality where people are indigent or have bad dietary habits and idiosyncrasies. Chronic alcoholism, as well as diseases of the digestive tract, seems to be a contributing factor. This vitamin is now often called *niacin* to prevent confusing it with nicotine.

(Pellagra has been known for centuries, and no nation is free



Good Sources of Vitamin C

Courtesy National Dairy Council

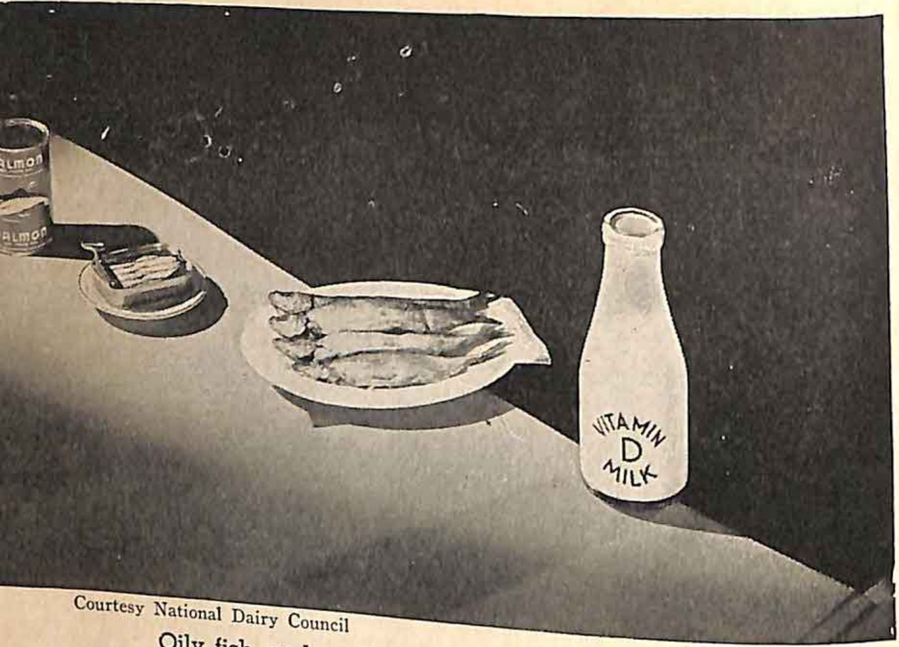
Fresh fruits, especially citrus fruits
Tomatoes, fresh and canned
Raw vegetables, especially cabbage

from it. It is a deficiency disease which affects the skin, making it rough and red, particularly on the forearms, hands, and legs. There is an inflammation of the tongue and a disturbance of the nervous system, with marked mental confusion and depression. The most outstanding symptoms of the disease are soreness of the mouth, digestive disorders, poor appetite, nausea, vomiting, loss of weight, diarrhea, and, in extreme cases, severe skin lesions.)

The best sources of riboflavin and nicotinic acid are yeast, muscle meat, liver, kidneys, milk, eggs, and leafy green vegetables. The common foods which meet the needs for other vitamins and minerals will provide protection against pellagra.

Vitamin C (ascorbic acid). This is the simplest of the vitamins in its chemical structure. It is found in citrus fruits, such as oranges, lemons, and grapefruit, in raw and cooked tomatoes and canned tomato juice, in green leafy vegetables (particularly cabbage), in potatoes, in grass, and in small amounts in raw meat.

Foods That Supply Vitamin D



Courtesy National Dairy Council

Oily fish, such as herring, sardines, salmon **Irradiated milk**

Vitamin C prevents scurvy, the deficiency disease, which results in swelling and bleeding of the gums, stiffness and swelling of the joints, and loosened teeth. Rarely is a true case of scurvy found in this country today, but mild symptoms of the disease are thought to be rather common among children and adults. One glass of fresh orange juice or fresh or canned tomato juice a day, without any of the other foods mentioned, is enough to supply the necessary intake of vitamin C.

Vitamin D ("sunshine vitamin"). This vitamin is essential to proper development of the bones and teeth. It aids in depositing calcium and phosphorus in the bones during growth, thereby preventing rickets. It is found in large amounts in the liver oils of cod and halibut and in very small amounts in butter, egg yolks, and milk. Most foods are poor sources of vitamin D.

The effect of the sun's rays is to activate in the skin a substance known as ergosterol (see p. 253). This produces the same effect in the body as does vitamin D taken by mouth. Light from an ultraviolet lamp is beneficial in the same way that sunshine is. However, the ultraviolet lamp should be used only under the direction of a physician or nurse. Exposing the body to sunlight or subjecting certain foods to irradiation will produce vitamin D. Light passing through a glass window is not effective in bringing about this change, since most of the ultraviolet light fails to pass through glass.

The vitamin-D value of milk, butter, and eggs varies with the season of the year and with the rations given the cattle and chickens. Milk, both fresh and evaporated, and a few cereal products are being reinforced with vitamin D. This enrichment may be gained either by irradiation through exposure to ultraviolet rays or by the addition of vitamin-D concentrates obtained from fish-liver oils.

Vitamin E (anti-sterility vitamin). This is a fat-soluble vitamin found in the germ of cereal grains, corn, cottonseed oil, leafy green vegetables, lean and fat beef, milk, and egg yolks. In rats fertility and the ability to produce young depend upon vitamin E. Our knowledge as to the relation of this vitamin to human beings is at present incomplete.

Vitamin K is a newly discovered fat-soluble vitamin which under certain conditions aids in the clotting of the blood.

Concentrated vitamins. An adequate diet provides the vitamins and minerals in sufficient amount for normal bodily health. The food faddists have seized upon the vitamins for exploitation. They have advertised the taking of vitamins to promote growth, for the health of the teeth, and as a protection against colds. Even certain cosmetic preparations are claimed to contain vitamins that will improve the beauty of the skin. The minerals have been exploited in the same way. This overemphasis on vitamins tends to create misleading impressions as to their exact value in the body.

There is no sound reason for promiscuously taking vitamins in tablets or capsules, or for believing that vitamin concentrates should be added to an already adequate diet. With the exception of vitamin D, vitamins should be derived from the food supply rather than from the drugstore. If vitamin deficiency is suspected, a physician should be consulted before money is spent on vitamin capsules or tablets.

Vitamin concentrates are prepared by reliable drug firms. The vitamins they contain may have been derived from some food substance, as in the case of the vitamin B_1 extracted from rice polishings. Or they may be synthetic vitamins having the same physiological effect as the vitamins extracted from foods. The number of International Units contained in each tablet or capsule is stated on the package label. There are two ways of stating the strength or quantity of vitamins, one in milligrams, the other in International Units. For example, 1 milligram of ascorbic acid is equivalent to 20 International Units, and 1 milligram of thiamin equals 333 International Units. When vitamin concentrates are purchased, the vitamin content should be considered in connection with the cost.

As far as possible, vitamins should be supplied through foods rather than in separate preparations. A safe rule to insure a sufficiency of vitamins is to include in the daily diet a variety of foods, giving special attention to milk, eggs, lean meats, green leafy

Summary of Vitamins

NAME	SIGNIFICANCE IN HEALTH	IMPORTANT SOURCES	OTHER FACTS
Vitamin A	Promotes growth. Related to the ability to see in dim light or to adapt to a changed intensity of light, preventing night-blindness. Protects against eye disease, xerophthalmia. Helps maintain normal resistance to infection in mucous membranes of the respiratory, digestive, and urinary organs, eyes, and tear glands.	*Foods* Liver Butter Cheese Eggs Cream Kidney Whole milk Green leafy and yellow vegetables Apricots, bananas, cherries *Medicinals* Fish-liver oils Vitamin A concentrates	Carotene (carrot-colored) in plants may be converted into vitamin A in the liver; hence, called "precursor" of vitamin A. Soluble in fat affected by high temperatures when oxygen is present. Not destroyed in ordinary cooking. Can be stored in the body.

Summary of Vitamins (*Continued*)

NAME	SIGNIFICANCE IN HEALTH	IMPORTANT SOURCES	OTHER FACTS
Vitamin D	Cooperates with A and C in utilization of calcium and phosphorus in bone structure and blood stream. Essential to building and maintenance of strong bones and teeth. Prevents rickets.	*Foods* Cod-liver and halibut-liver oils Butterfat Egg yolk Irradiated foods: cereals, yeast, milk *Medicinals* Fish-liver oils Irradiated ergosterol Ultraviolet irradiation Viosterol	Soluble in fat. Fairly stable to heat and oxidation. Ergosterol, precursor, found in cholesterol when irradiated by ultraviolet rays. Action of sunshine on the skin activates vitamin D in the body.
Thiamin vitamin B_1 (member of the vitamin-B complex)	Promotes normal growth and development. Essential for utilization of carbohydrate foods. Helps maintain normal appetite. Promotes normal intestinal function. Required for normal reproduction and for milk production in nursing mothers. Helps to prevent fatigue and nervousness. Prevents beriberi.	*Foods* Kidney Liver Pork (lean) Dried, whole, or skim milk Egg yolk Fresh milk Oysters Dry legumes (beans, peas, lentils, peanuts) Soybeans Whole grain cereals Oatmeal Rice (unpolished) Wheat germ Oranges "Enriched" bread and flour Nuts *Medicinals* Wheat germ Compressed yeast Dried brewer's yeast	Cannot be stored in the body; must be provided daily. Soluble in water. Stable in dry form. Destroyed by excessive heating. Destroyed by baking soda in cooking vegetables.

Summary of Vitamins (*Continued*)

NAME	SIGNIFICANCE IN HEALTH	IMPORTANT SOURCES	OTHER FACTS
Riboflavin vitamin G (B_2) (member of the vitamin-B complex)	Essential to growth and normal nutrition. Prevents cheilosis (cracking of the lips). Promotes cell respiration. Helps to protect against certain eye disorders.	*Foods* Liver Kidney Lean muscle meat Cheese Egg yolk Whole milk Wheat germ Peanuts Green and leafy vegetables	Soluble in water. Relatively resistant to heat, acid, and oxidation. Deteriorates on exposure to sunlight. Destroyed in cooking with baking soda.
Vitamin B_{12}	Overcomes pernicious anemia. Stimulates appetite.	Liver Dark-green, leafy vegetables	
Niacin or nicotinic acid, vitamin P-P (pellagra-preventive factor) (Member of vitamin-B complex)	Maintains normal function of the skin. Maintains normal function of gastrointestinal tract. Prevents pellagra (rough, red skin).	*Foods* Liver Kidney Lean meat Milk Wheat germ Green peas Turnip greens *Medicinals* Compressed yeast Dried brewer's yeast Concentrates	Soluble in water. Resistant to heat, light, and oxidation.
Vitamin C ascorbic acid	Essential to normal bone structure. Promotes firm gums and teeth. Regulates cell respiration. Prevents irritability. Increases resistance to infection. Helps to defer aging process. Prevents scurvy.	*Foods* Oranges and other citrus fruits Tomatoes (raw and canned) Raw vegetables: cabbage, onions Potatoes Green peppers Pineapple Strawberries Bananas Sauerkraut Sprouted seeds *Medicinals* Concentrates of ascorbic acid	Soluble in water. Destroyed by exposure to air, light, and alkali. Oxidizes readily in alkaline solution. Cannot be stored in the body.

vegetables, fresh fruits and vegetables, and whole grain or enriched cereals and breads. These are classed as protective foods. Some of these foods should be taken raw, since heat destroys thiamin and vitamin C. Foods heated without contact with air (as in commercial canning) and those containing acids retain a goodly proportion of vitamin C in spite of heating.

Correct cooking. Because several of the vitamins, as well as many of the minerals, are soluble in water, the methods of preparing vegetables and fruits are of great importance. Vegetables and fruits should be pared and cut just before using. Vegetables should be cooked in a small amount of boiling water and until slightly tender. The water in which the vegetables are cooked may sometimes be used in soups, gravies, and cream sauces in order to save the vitamins and minerals which are dissolved in it. The use of soda in the cooking of green vegetables may save the color but destroys the valuable B_1 vitamin.

Acid-forming and base-forming foods. Chemical substances are alkaline (basic), acid, or neutral. The blood, which is a complicated chemical fluid, is normally slightly alkaline. If it loses this alkalinity, it will not perform its functions properly. Foods are classified as base- (alkali-) forming or acid-forming. These terms refer to the chemical reaction (acid or alkaline) of the end products which they yield after being oxidized in the body, not to the flavor or taste of food. The body needs both types of foods; but in order to maintain the alkalinity of the blood, there should be a slight predominance of the base-forming foods. Milk, nuts, vegetables (except corn), and fruits (except plums, prunes, rhubarb, and cranberries) are base-forming foods. Acid-forming foods are meat, fish, poultry, eggs, cereal products, corn, and the fruits mentioned above as not base-forming. An adequate diet is therefore the best means of keeping the blood normal.

The selection of food. In the game of eating for health, all of the essential food materials must be provided somewhere in the three meals eaten daily. The right kind and amount of food should be taken each day.

The term "adequate meal" sometimes gives an idea that much technical knowledge of nutrition and dietetics is necessary. It

Get the Good... FROM VEGETABLES

• Wash quickly.... don't soak

• Keep cool.... keep in nature's covering until ready to cook

• Cut just before using

Courtesy U. S. Bureau of Human Nutrition and Home Economics

merely means having enough of the kinds of food which any person requires to meet his particular needs. These needs are dependent on his age and size, his activities, and his state of health. A well-chosen diet may make it possible for one to perform those physical feats which one desires, to think clearly, and to present

Courtesy U. S. Bureau of Human Nutrition and Home Economics

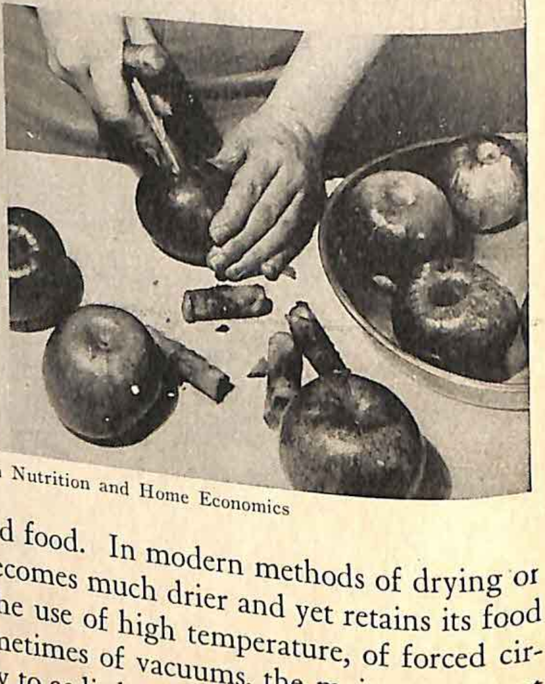
that healthy appearance which contributes to a wholesome personality.

Dehydrated foods. For centuries man has dried certain foods in order to preserve them for future use. This natural drying by the wind or in the sun usually left at least a quarter of the origi-

Get the Good... FROM FRUIT

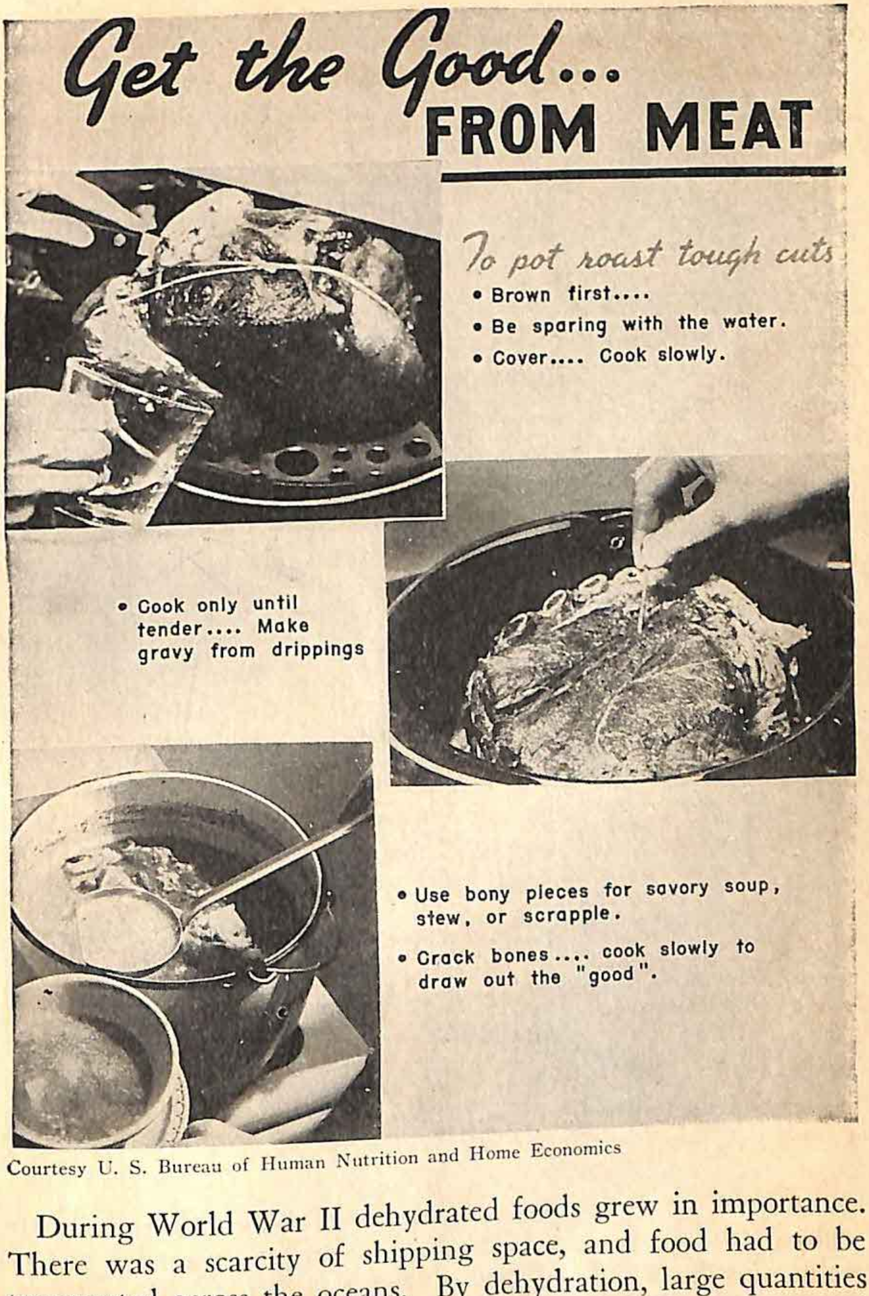
• Use fruit juice *fresh*.... if it has to stand, keep covered and cold.

• Cook in the peel if you can....if you must peel, make it thin.



Courtesy U. S. Bureau of Human Nutrition and Home Economics

nal moisture in the dried food. In modern methods of drying or dehydration the food becomes much drier and yet retains its food value and flavor. By the use of high temperature, of forced circulation of air, and sometimes of vacuums, the moisture content is brought down rapidly to as little as 3 percent.



Get the Good... FROM MEAT

To pot roast tough cuts

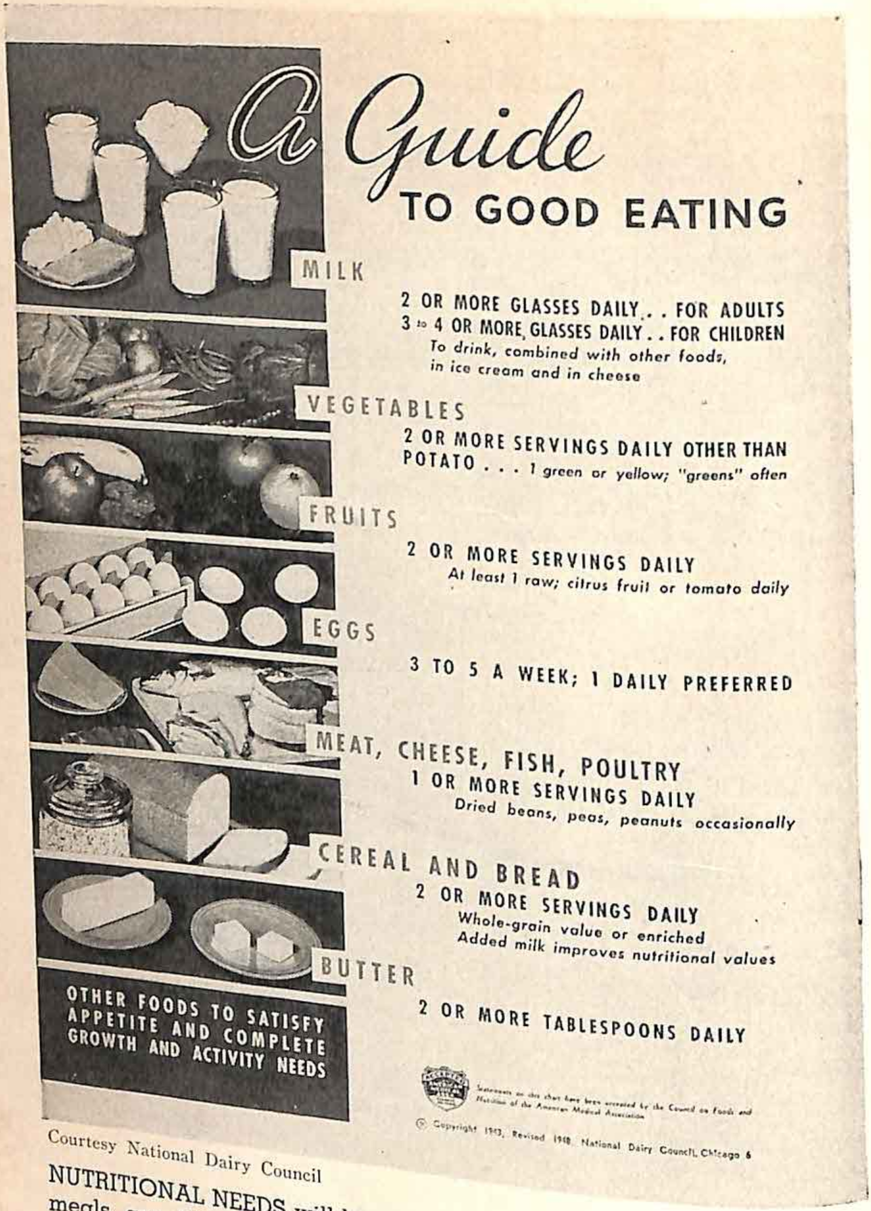
- Brown first....
- Be sparing with the water.
- Cover.... Cook slowly.

- Cook only until tender.... Make gravy from drippings

- Use bony pieces for savory soup, stew, or scrapple.
- Crack bones.... cook slowly to draw out the "good".

Courtesy U. S. Bureau of Human Nutrition and Home Economics

During World War II dehydrated foods grew in importance. There was a scarcity of shipping space, and food had to be transported across the oceans. By dehydration, large quantities of food can be preserved in greatly reduced bulk. Dehydrated foods when packaged for ocean shipment sometimes take as little



A Guide TO GOOD EATING

MILK

2 OR MORE GLASSES DAILY . . FOR ADULTS
3 to 4 OR MORE GLASSES DAILY . . FOR CHILDREN
To drink, combined with other foods, in ice cream and in cheese

VEGETABLES

2 OR MORE SERVINGS DAILY OTHER THAN POTATO . . . *1 green or yellow; "greens" often*

FRUITS

2 OR MORE SERVINGS DAILY
At least 1 raw; citrus fruit or tomato daily

EGGS

3 TO 5 A WEEK; 1 DAILY PREFERRED

MEAT, CHEESE, FISH, POULTRY

1 OR MORE SERVINGS DAILY
Dried beans, peas, peanuts occasionally

CEREAL AND BREAD

2 OR MORE SERVINGS DAILY
Whole-grain value or enriched
Added milk improves nutritional values

BUTTER

2 OR MORE TABLESPOONS DAILY

OTHER FOODS TO SATISFY APPETITE AND COMPLETE GROWTH AND ACTIVITY NEEDS

Statements on this chart have been accepted by the Council on Foods and Nutrition of the American Medical Association

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Courtesy National Dairy Council

NUTRITIONAL NEEDS will be satisfied if these simple rules for planning meals are followed everyday. They provide for essential proteins, vitamins, and minerals. Other foods may be taken in addition to these seven basic groups. Eat what you want after you have eaten what you need.

Courtesy Denver Public Schools

THE SCHOOL lunch is as important a meal as any other in the day. Are you always careful to select the best combination of foods for your daily needs?

as one-sixth of the cargo space required by similar foods not so treated, and they do not need refrigeration. Fresh vegetables dehydrated contain about the same amounts of protein, carbohydrates, and minerals as most fresh vegetables after shipping and exposure for sale. They may even contain more vitamins.

Dehydrated fruits are edible in the dry state, although they must be chewed much more thoroughly than the fresh fruits. Bars of compressed apricots, raisins, prunes, dates, and other fruits are often included in food packs for hikers, campers, and sportsmen. They are welcome wherever packing space is at a premium.

Frozen foods. Meats, fish, some cooked foods, vegetables, fruits, and concentrated fruit juices now are frozen and packaged. Vitamins and natural flavors are retained well in the frozen products and cellulose is softened so that only brief cooking is needed.

Courtesy U. S. Bureau of Human Nutrition and Home Economics

BY CAREFUL planning, meals including the essential food elements can be prepared at a reasonable cost.

Food, a health essential. Although we have an abundant food supply in the United States, evidences of malnutrition exist throughout the country among both the rich and the poor. In some cities where studies of diets have been made, it has been estimated that one-fifth of the families are not getting the right kind and amount of food. Some families fail to secure satisfactory diets because they lack a knowledge of the fundamentals of nutrition; others are unable to buy enough food.

Better nutrition can come only when people are interested in knowing how to get the best possible diet for what they have to spend. Through careful selections of food and the development of skill in buying and preparing food, and with little or no increase in expenditure, it is possible to select diets that are much better nutritionally. In most communities opportunities are afforded by which people can become better informed. Among these are the extension services of schools and colleges; club study groups; health centers; and child welfare, public health, and nutrition clinics.

Safeguarding our food supply and keeping the food costs within the purchasing power of the low-income groups should be a part of our national health protection program.

Alternate foods. Sometimes it is difficult to obtain certain foods to which one has been accustomed. This is particularly true when the supply of any food is inadequate. A person who wishes to maintain an adequate diet should be familiar with other foods that may be substituted or alternated.

In place of meat, fish, and cheese, peanuts and dried peas and beans may be substituted. Oleomargarine reinforced with vitamin A can take the place of butter. Equally good for cooking are lard, suet, poultry fats, and vegetable fats and oils. Peanut butter makes a nutritious spread.

Corn sugar, molasses, sirup, and honey can supplement the supply of beet and cane sugar available. Potatoes, dried beans, raw cabbage, and carrots can be used in place of canned corn, peas, green beans, and tomatoes.

Some previously unfamiliar foods are becoming a part of the American diet. Among these is the soybean, an important food in the Far East. The soybean furnishes complete proteins and can be used as a substitute for meat. It is now used as a base in meat substitutes, in bakery goods, macaroni products, soups, milk, and ice cream. Wheat flour is deficient in some amino acids (see p. 157) that are present in soybean flour. The oil from soybeans can be used to replace vegetable oils and fats formerly imported. The soybean is being used in candy bars, for nuts, and as a substitute for peanuts.

In conclusion

FOOD is, perhaps, the most important single factor in health. It is therefore necessary that the food we eat be selected carefully to meet our daily needs. The power to do each day's work comes largely from food eaten the day before or perhaps several days previously.

Activities

1. Keep a careful account of your diet for a day, or longer if desired, including all lunches and food eaten between meals. Consult a caloric chart and place foods eaten under the following headings: Foods, Number of Calories of Proteins, Number of Calories of Fats, Number of Calories of Carbohydrates, Total. Criticize your diet from the standpoint of a) number of calories, b) building foods, c) vitamins, d) minerals. In what respects could your diet be improved?

2. Make a list of ten cheap foods that are valuable, stating reasons for your choice.

3. Keep a schedule of your meal hours for one week.

4. Plan a school luncheon which will supply vitamins A, B, C, and D.

5. Make a list of food fads and fancies from a study of advertisements in magazines and elsewhere.

6. Make a list of all the sayings about diet and eating that you know. Point out the sound and irrational features of each.

7. Appoint a committee to make observations in the school lunchroom and to make a report to the class. Does the student body, in general, select correct foods at luncheon?

8. Write a report on the history of vitamins.

9. Write a report on how the number of calories in a given amount of food is determined.

10. How is the build of your body influenced by hereditary and environmental factors?

Test

Directions: Each of the following statements is either true or false. On a separate sheet of paper write a column of numbers from 1 to 20, corresponding to the numbers of the statements. Write **T** after the number if the statement is true and **F** if the statement is false. Do not write in the book.

1. Every person should know his own food needs as accurately as possible.
2. Proteins are the best source of energy.
3. Every person needs carbohydrates and fats to keep warm.
4. Proteins may be obtained from both plant and animal sources.

5. Protective foods are essential for growth, protection from disease, and regulation of body processes.
6. Enriched foods have had the vitamins removed.
7. Vegetable proteins supply all the proteins necessary for building and repair.
8. Fresh fruits and vegetables are important sources of vitamins and minerals.
9. Canned tomatoes are a good substitute for fresh citrus fruits.
10. All fruits and vegetables contain some carbohydrates.
11. Vitamins are destroyed by cooking foods at high temperature.
12. The only minerals essential to the body are calcium and iodine.
13. Eggs are a source of vitamin A, protein, and iron.
14. Water in which vegetables are cooked should be thrown away because it has a strong taste.
15. There are only three vitamins—A, B, and C.
16. We need daily: milk; butter; 2 carbohydrate foods; 2 vegetables, one cooked and one raw; and 2 fruits, one of which may be cooked.
17. Excellent sources of vitamin C are orange juice, cabbage, tomatoes, asparagus, and other green vegetables.
18. All the water the body needs is obtained from the food we eat.
19. Dehydrated vegetables have much smaller amounts of protein, carbohydrates, and minerals than fresh vegetables.
20. One-fifth of the families in the United States are not getting the right kind and amount of food.

Associated subjects

Biology: Nutrition as an important life process. . . . The kinds and chemical composition of foods. . . . The meaning of calorie. . . . The selection of a balanced meal. . . . Proper choice of foods. . . . Manufacture of foods by plants.

Chemistry: Tests for various food compounds. . . . Analysis of certain foods. . . . Character of acid and alkali foods. . . . Methods of manufacturing commercial food products. . . . Sources of mineral salts. . . . Synthetic vitamins.

Home economics: Preparation of digestible foods and appropriate food combinations. . . . The etiquette of eating. . . . Calculation of calorie needs.

Physical education: The need for special diets when in training and for weight control.

References

AMIDON, BRADBURY, and DRENCKHAHN. *Good Food and Nutrition.*
BOGERT. *Nutrition and Physical Fitness.*
BOORSOOK. *Vitamins, What They Are and How They Can Benefit You.*
COOPER, BARBER, and MITCHELL. *Nutrition in Health and Disease.*
DAVIS. *Vitality Through Planned Nutrition.*
GORRELL, MCKAY, and ZUILL. *Food and Family Living.*
HARRIS and LACEY. *Everyday Foods.*
MCCOLLUM and BECKER. *Food, Nutrition, and Health.*
MCDERMOTT, TRILLING, and NICHOLAS. *Food for Better Living.*
SHERMAN. *Food for Health.*
WILLIAMS. *Healthful Living.*

Films

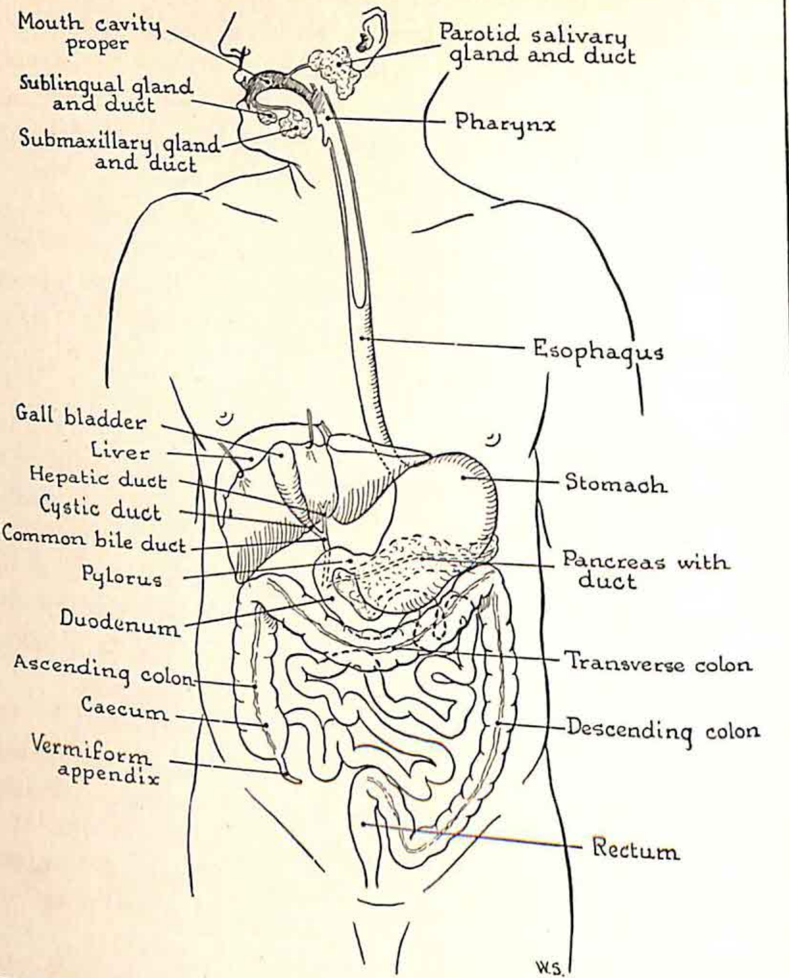
Foods and Nutrition. 11 minutes, sound. Encyclopaedia Britannica.
Proof of the Pudding. 11 minutes, sound, color. Metropolitan.
Strange Hunger. 33 minutes, sound. National Vitamin Foundation.
Vitamin B_1. 15 minutes, silent. Encyclopaedia Britannica.
Vitamin D. 15 minutes, silent. Encyclopaedia Britannica.

13. FOODS UNDERGO MANY CHANGES IN THE BODY

IN THE preceding chapter you learned how to select your food. Yet food, however carefully chosen and prepared, cannot become a part of your body until it undergoes a series of complicated changes. An understanding of what happens to the food before it can go into the blood stream will help your physical development. It will lay the foundation for right eating habits and will make you more likely to get maximum benefits from the foods you select.

Do you know . . .

1. *What happens to the food while in the mouth?*
2. *What acid is formed in the stomach?*
3. *How food moves through the intestine?*
4. *How long food remains in the stomach?*
5. *If the appetite is a reliable guide as to what and when to eat?*
6. *Why you should not bathe or swim right after eating?*
7. *Why food will digest more easily if eaten slowly?*
8. *What effect seasoning of foods has on digestion?*
9. *Why fried foods are hard to digest?*
10. *What is the cause of hunger?*
11. *Why one should eat breakfast even if one is not hungry?*
12. *Why iced foods may be harmful?*
13. *Why we should not eat soft foods only?*
14. *If there is any harm in eating before going to bed?*
15. *If it is harmful to drink water with the meals?*
16. *Why one gets a headache when hungry?*
17. *Why a skin rash develops sometimes after eating certain foods?*
18. *What causes indigestion?*
19. *Why one sometimes vomits after eating spoiled food?*
20. *How height and weight charts are made?*
21. *What malnutrition is?*
22. *What causes excessive overweight?* (See chap. 19.)
23. *How reducing diets may be harmful?*
24. *If overweight runs in families?*
25. *What causes constipation?*



IN THIS DIAGRAM of the digestive system, the liver and gall bladder are shown turned upward and to the right.

Digestion. Digestion is the changing of raw food materials into soluble or liquid form for use by the body cells. This process takes place in a long tube called the *alimentary canal*. In the illustration above, you can follow the course of the food through the *mouth*, down the *esophagus* or *gullet* to the *stomach*, and into the *small intestine*. Into the *large intestine* the undigested food passes to be eliminated from the body. Besides these, you will also note the special digestive glands along the course of the tube: three pairs of *salivary glands*, the *liver*, and the *pancreas*.

Enzymes. The chemical changes in the food are brought about by a series of enzymes secreted by the various digestive glands. The purpose of these enzymes is to aid in breaking down the complex food substances into simpler forms so that they will dissolve in water and be ready for absorption into the blood stream. A particular enzyme acts on a particular class of foodstuffs and has no action on any other. Thus *ptyalin*, the enzyme in saliva, acts on starch; *pepsin*, the enzyme in the gastric juice, acts on protein.

The first step. In the mouth, chewing separates the food into fine particles. This produces a large increase in the surface exposed to the digestive juices. The enzyme ptyalin in the saliva (also called the salivary amylase) changes starch to maltose, a form of sugar. Ptyalin has no action upon cellulose. For this reason starch must always be cooked in order that the cellulose envelope surrounding the starch grain may be broken. Slow, thorough chewing greatly aids the process of digestion.

Under the stimulus of the flavor of food, and aided by the muscular action of chewing, the salivary glands pour *saliva* into the mouth. Two pairs of these glands empty into the mouth near the lower front teeth and of the third pair one opens on the inner surface of each cheek opposite the second molar tooth of the upper jaw. The act of chewing also starts the flow of gastric juice into the stomach.

Saliva is a slimy, slightly sticky, watery fluid. It moistens the food and stimulates the sense of taste. All solid substances must be dissolved in saliva in order that they may act upon the taste buds. The constant flow of saliva also exerts a very necessary cleansing effect. The mouth and teeth are rinsed and kept free from food and other particles. The saliva forms the food into a moist, soft ball so that it can be easily swallowed.

Swallowing. The tongue pushes the food backward to the place where the muscles in the esophagus can get hold of it. At the same time other muscles bring the larynx upward and forward under the base of the tongue. This movement also brings the opening of the esophagus close to the base of the tongue. A cartilage called the *epiglottis* prevents food from dropping into the opening to the windpipe. As soon as the muscles of the esophagus grasp the food, they carry it along with a rhythmic, wavelike motion called *peristalsis*. In this movement the muscles below the food relax and those above the food contract. In all parts of the alimentary canal food is pushed along in this manner.

THE STOMACH is greatly enlarged from its natural size (top) after a meal (bottom).

The second step. The stomach is a collapsible pouch which can hold about two quarts and into which goes the food from the mouth. At the receiving end of the stomach, the digestion of starch, begun in the mouth, may continue for some time. Finally the contraction waves of the stomach carry the contents forward, churning them so as to mix them with the gastric juice.

Digestion in the stomach is readily affected by the general nervous state of the person. Excitement, worry, anger, chilling, fatigue, all tend to slow the digestive process. On the other hand, appetizing food and a happy mood aid this process.

In the mucous lining of the stomach are numerous gastric glands which secrete two enzymes, *pepsin* and *rennin*. Rennin curdles milk. This prevents the milk from passing quickly from the stomach and holds it back for the digestion of its protein. Rennin is much more abundant in the stomachs of young children than in those of adults. Pepsin breaks down the proteins into *peptones* (liquid proteins). Before peptones can be utilized by the body, they must be broken down further into *amino acids*, the building materials of new tissues. Pepsin really begins the digestion of protein, but unless hydrochloric acid is present no digestive change will take place. About 0.3 percent of the gastric juice is hydrochloric acid, which makes the contents of the stomach acid.

As soon as food enters the stomach, peristaltic waves move slowly from the large end to the small end leading into the small intestine. The opening (*pylorus*) between the stomach and the small intestine is guarded by a ring of muscle. The food in the lower end of the stomach is gradually changed to a semiliquid mass called *chyme*. When some of the chyme becomes acid enough, the pyloric valve opens and permits a small quantity of it to enter the small intestine, ready for the next step in digestion. About two and one-half to five hours are required for a meal to pass through the stomach.

Carbohydrates digest more rapidly than proteins, and proteins more rapidly than fats. A mixture of protein and fats is digested more slowly than other combinations of foods.

The third step. The work of the mouth and stomach just starts the digestive process, and the greater part of digestion is carried on in the small intestine. The *duodenum* forms a curve extending from the pylorus back under the stomach. Between the stomach and duodenum lies the *pancreas,* resembling a pink tongue-shaped body. The pancreas is a very important organ, both in digestion and in the release of energy (see p. 298). It is composed of numerous branching, tubelike glands, each with a duct that joins others to form a larger tube which runs through the middle of the pancreas and opens into the duodenum.

At intervals the pylorus spurts a portion of the semifluid contents of the stomach (*chyme*) into the duodenum. The acid in the chyme stimulates the wall of the duodenum to produce *secretin* which the blood absorbs and carries at once to the pancreas and the liver. Secretin is not an enzyme, but a hormone (see p. 294), and so causes both the liver and the pancreas to become active and pour fluids into the duodenum.

The pancreas then secretes and pours its juice into the duodenum. The pancreatic juice contains three enzymes: one to digest protein, one to digest starch, and one to digest fats and oils.

The digestion of proteins which was begun in the stomach is completed by the pancreatic juice. The pancreatic enzyme *trypsin* changes the undigested proteins and peptones to amino acids. These can be absorbed by the blood. A very few partially digested proteins may escape and be acted upon by another enzyme in the small intestine. Trypsin can cause no digestive changes when the food is acid, so the food from the stomach must be made alkaline when it reaches the duodenum. The change from acid to alkaline is brought about by *bile*.

The liver. The liver secretes bile, which is a greenish or reddish-yellow fluid, bitter in taste, containing alkaline salts. The bile contains no enzyme, but is necessary in the action of enzymes in the pancreatic juice. It also plays an important part in absorption.

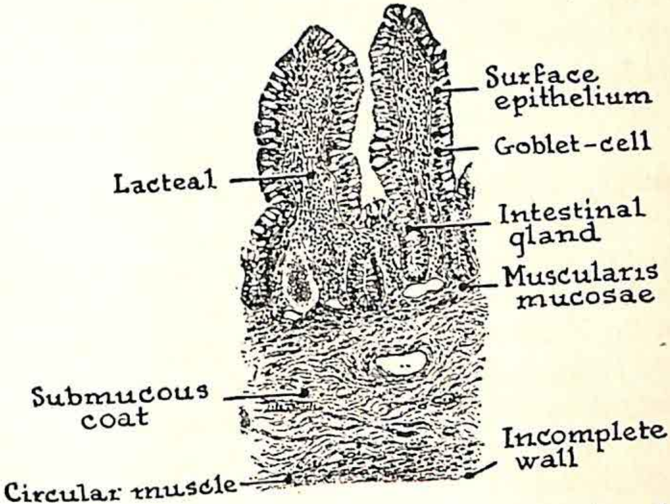
Digestion completed. All the starch that ptyalin failed to digest in the mouth and the upper part of the stomach must now be digested in the duodenum and small intestine by the *amylase* enzyme from the pancreas. The fats, which, until they have reached the duodenum, have found no digestive enzyme, have had some preparation in the stomach, the protein coverings which surround the particles of fat being dissolved there. In the duodenum the *lipase* or *steapsin* now breaks up the fats into *fatty acids* and *glycerine*.

Bile contains alkaline compounds of sodium and potassium which neutralize all acids, changing a certain proportion of the fatty acids to soaps. The soaps readily dissolve and pass into the blood and lymph vessels in the wall of the intestine.

Glucose and two other simple sugars can be absorbed without digestion from any part of the alimentary canal. Cane sugar, malt sugar (from partly digested starch), and milk sugar must wait until they reach the small intestine. Each of these sugars requires a separate enzyme for its digestion. In the mucous lining of the small intestine are thousands of small intestinal glands. Five different enzymes are known to be produced by these glands. Three of these digest each a different kind of sugar.

The time required normally for the food to travel through the digestive tract is between twenty-four and forty-eight hours. The food has to travel through the entire small intestine before reaching the large intestine.

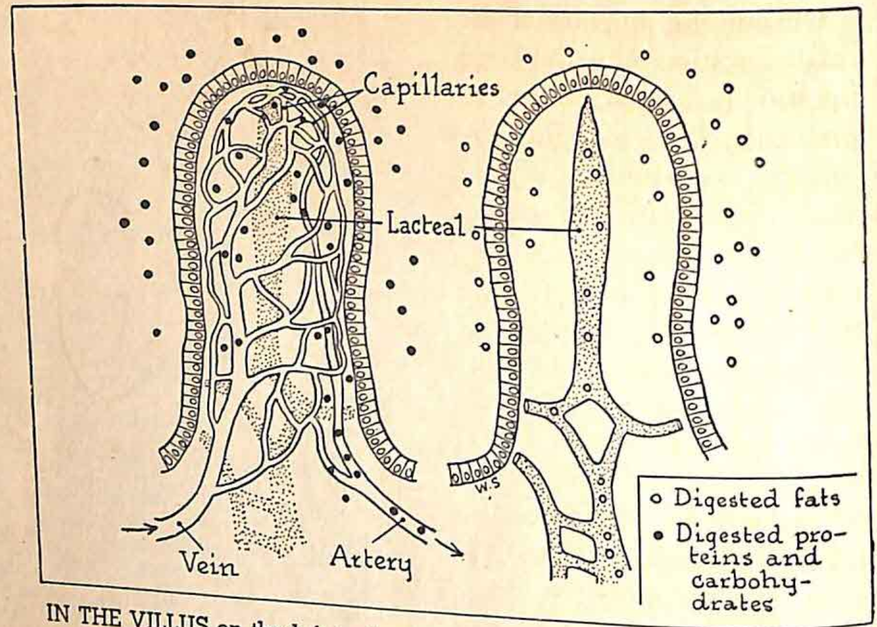
Absorption. The small intestine is a long, hollow tube about one inch in diameter and twenty feet long. In order that it may fit into the small space provided, it is looped and coiled many times upon itself. It is held in place by a transparent membrane of connective tissue called the *mesentery* which is attached to the abdominal wall near the spinal column. It is further supported by the abdominal wall and muscles.



THE VILLI are small projections on the inner surface of the small intestine. This lengthwise section, magnified 150 times, shows the thin-walled epithelial cells on the outside of each villus. Liquids pass readily through these cells into the lacteals and blood capillaries.

This long, coiled tube presents greater secreting and absorbing surface. It also brings about more complete digestion by holding the food longer under the influence of digestive juices. The small intestine is as important an organ for absorbing food as for digesting it. There are numberless tiny projections called *villi* on the inner surface of the small intestine. These projections, which give the lining a velvety appearance, play an important part in absorption of the digested food.

Beneath the outer cells of each villus are tiny blood vessels which take the digested proteins and carbohydrates into the blood stream which flows to the liver. Running through the middle of each



IN THE VILLUS on the left is shown a network of capillaries surrounding a lacteal. The black dots; representing digested proteins and carbohydrates, indicate how the liquid food enters the blood stream. In the villus on the right the capillaries have been removed to show the lacteal. The unshaded balls, representing digested fats, enter the lacteal.

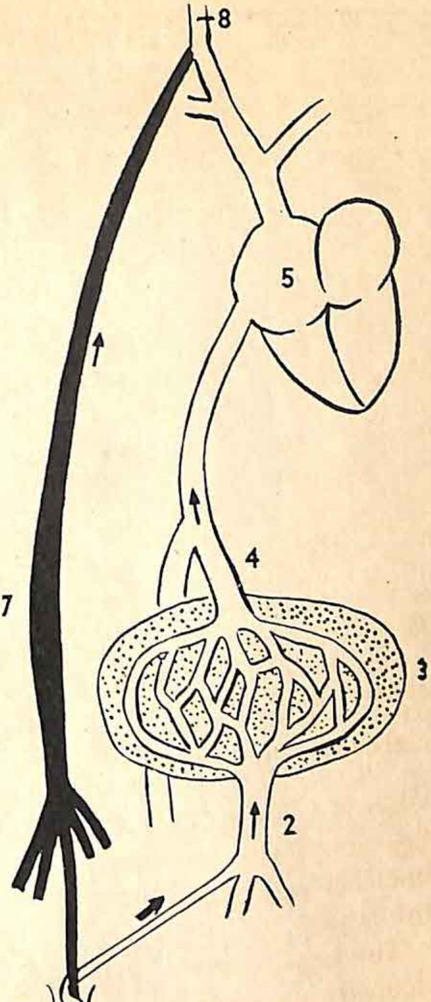
villus is a vessel called a *lacteal*. Through the lacteals, digested fats are slowly absorbed and emptied into larger and larger branches of a single tube which empties into a vein leading to the heart.

The large intestine. The large intestine is about two inches in diameter and five feet in length. It includes the cecum, the *colon,* and the rectum. No digestion takes place in the colon except a possible continuation of digestion previously started. Absorbable materials, largely water, may pass through the walls. This absorption of water sometimes increases the difficulty with which accumulated waste products are eliminated. The walls of the colon are supplied with mucous glands which add mucus to lubricate the mass and to prevent friction as it moves along. Frequently headaches and lack of energy, and sometimes stomach and intestinal upsets, are caused by failure to eliminate this waste regularly from the body.

Outside the junction of the small intestine with the large intestine is a small, fingerlike projection known as the vermiform (wormlike) *appendix.* The appendix apparently has no function in the human body. Bacterial action in this organ may produce a condition known as *appendicitis.* In case of persistent abdominal pain of any intensity, a physician should be consulted. The use of a laxative or an enema in suspicious cases should be avoided.

We are not conscious of digestion if it proceeds as it should. An uncomfortable feeling, a pain, or any other digestive disturbance is abnormal. It may indicate that too much or wrong food has been taken; that the food has been eaten too hastily; or that some serious condition is threatened. Such signs should not be neglected.

Constipation. A delay in the elimination of the waste material from the colon is called *constipation* (see p. 241). Constipation is not a disease but merely a symptom of disease or of disordered function. There are at least three types of constipation,



DIGESTED proteins and carbohydrates pass into a villus (*1*), go through the portal vein (2) to the liver (3), where excess sugar is stored as glycogen. From here it passes through a vein (4) to the heart (5). The digested fats go into a lacteal (6), then by lymph vessels (7) to a vein on the left side of the neck (8).

but the most prevalent results from inactivity of the muscles of the bowel. This loss of tone of the intestine may be caused by eating too much food, drinking too little water, lack of exercise, a poorly selected diet, a combination of the last two, or irregular habits of elimination.

Some of the symptoms of constipation are headache, bad breath, loss of appetite, and a feeling of fullness in the abdomen. It is no longer held that these symptoms are caused by the absorption of poisons from the accumulated waste materials, but rather that they are reflex manifestations arising from the distended colon.

To promote movement in the digestive tract, it is a good practice to drink one or two glasses of water on rising in the morning. The water stimulates certain nerve endings long before it has time to reach the colon. Those types of exercise which involve the muscles of the waist and diaphragm promote movement of the intestinal muscles. Gentle physical activity after the meal also favors such action. Occasional abstention from food is sometimes helpful in overcoming constipation.

The diet should contain foods rich in cellulose, such as vegetables and fruits. Vitamin B_1, which is found in these foods, is an important factor in maintaining the muscle tone of the large intestine. Eating meals at regular intervals is also beneficial.

An important factor in preventing constipation is the establishment in infancy and the maintenance throughout life of regular habits of elimination (see p. 240). In many cases constipation is induced and becomes chronic because of lack of attention to this health habit. The abuse of laxatives (see p. 352) increases the tendency to chronic constipation. Many cathartics owe their action to the principle of drawing water into the intestines from the blood and the surrounding tissues. The additional liquid seems to dilute the contents and helps to stimulate peristaltic movements. But the muscles become dependent upon repetition or increase of the same treatment, and elimination is again delayed. A person subject to chronic constipation, especially if associated with the frequent use of cathartics, should consult a competent physician.

Hunger and appetite. Neither hunger nor appetite can be relied upon absolutely as a guide to eating. It is unwise to eat only

Courtesy Women's City Club of Detroit

FOOD that looks good not only tastes good but is digested thoroughly. It appeals to appetite by its color and arrangement as well as by its flavor. Glands are stimulated to produce digestive juices and muscular action is promoted.

when one is hungry. It is equally inadvisable to eat whenever one feels a bare suggestion of hunger, or to eat only those foods which especially appeal to the appetite.

Normal hunger expresses the natural need of the body for nourishment. It is caused by contraction of the muscles of the stomach, usually while it is empty. Almost any substance—water, food, or even a non-nutritive material—put into the stomach will check this feeling of hunger temporarily. Normal appetite is the agreeable desire for food. A depraved appetite is an unwholesome desire for certain foods out of harmony with the best interests of the body. The person who understands what kinds of foods the body needs would do well to cultivate an appetite for those foods. If sufficient attention is paid to the results of right or wrong eating, appetite may be trained so that it will be a reliable guide to eating. In those persons who take the pains to train a sensible appetite, the sense of hunger will appear at the right time, and appetite will be keen for the kinds of foods that the body needs.

Health and eating habits. The relationship between one's health and one's eating habits is very close. (See the opposite page.) A food may contain the proper materials for the body's needs but be entirely indigestible because of the way it is prepared, or because of the time, the manner, or the amount eaten.

A regular schedule for eating is the first step in good digestion. The digestive tract, like the rest of the body, works better if it has regular, alternating rest and work periods. The food for the day should be fairly well divided between the three meals. Omitting one meal may cause overloading of the stomach at another meal, with a consequent tax on the digestive organs.

Some girls and a very few boys claim they have no appetite for breakfast. It is unwise to attempt a morning's work without some nourishment, and so every effort should be made to improve upon a sluggish appetite for breakfast. Light exercise, a cold bath, and a drink of water on rising are good stimulants to appetite. If the appetite is poor, the food should be light and easily digestible.

Eating between meals is a common dietary fault of high school boys and girls. Even a piece of candy or a malted milk needs to be digested and, if eaten between meals, deprives the stomach of its rest period and takes away the appetite for more necessary foods at mealtime.

Interfering with digestion. The digestive system is normally strong and able to withstand much abuse from overwork and wrong feeding. Occasionally, however, the organs of digestion rebel against mistreatment and thus call a temporary halt to abuse. Digestive disturbances are usually warnings that we are not eating correctly. A coated tongue, canker sores, or a headache may mean too little or too much food, the wrong type of food, or a clogged intestinal tract.

Eating Habits Worth Cultivating

1. Chew food well. Besides preparing the food for further digestion, chewing exercises the gums and teeth.
2. Think of pleasant things during the meal. This stimulates the flow of the digestive juices.
3. Drink water with meals but not to wash down solid food which needs chewing longer.
4. Take iced foods and drinks into the system slowly so that the temperature of the stomach will not be lowered greatly.
5. Avoid very highly seasoned foods.
6. Be moderate in your use of fried foods, rich pastries, pork, and whipped cream.
7. Do not eat more than you need for satisfying your hunger. Overeating may upset digestion and also cause overweight.
8. Eat sweets at the end of the meal so that they will not take away the appetite before the "must" foods have been eaten.
9. Learn to eat many kinds of foods. Avoid fussiness about food. Frequently food aversions are imaginary—a result of faulty early training—and may be corrected.
10. Omit from the diet any food to which it has definitely been shown that you are sensitive.
11. Do not bathe, swim, or carry on any active exercise directly after eating, because you will be drawing blood away from the stomach where it is needed for digestion.
12. Watch your posture while eating. Poor posture may cramp digestive organs and interfere with circulation of blood through them.
13. Rest a while before and after eating. Digestion of food is difficult if one is very tired.
14. Do not be afraid to eat foods in combination. They are usually not hard to digest unless one of the group is injurious when eaten alone.
15. Wash your hands before eating.

Belching after a meal is due to expulsion of small amounts of gas from the stomach into the esophagus and mouth. It is brought about by reverse waves originating in the upper region of the stomach and ascending to the esophagus. The gas in these instances is simply air which has been previously swallowed, and is not, as a rule, produced by digestive or fermentation processes in the stomach.

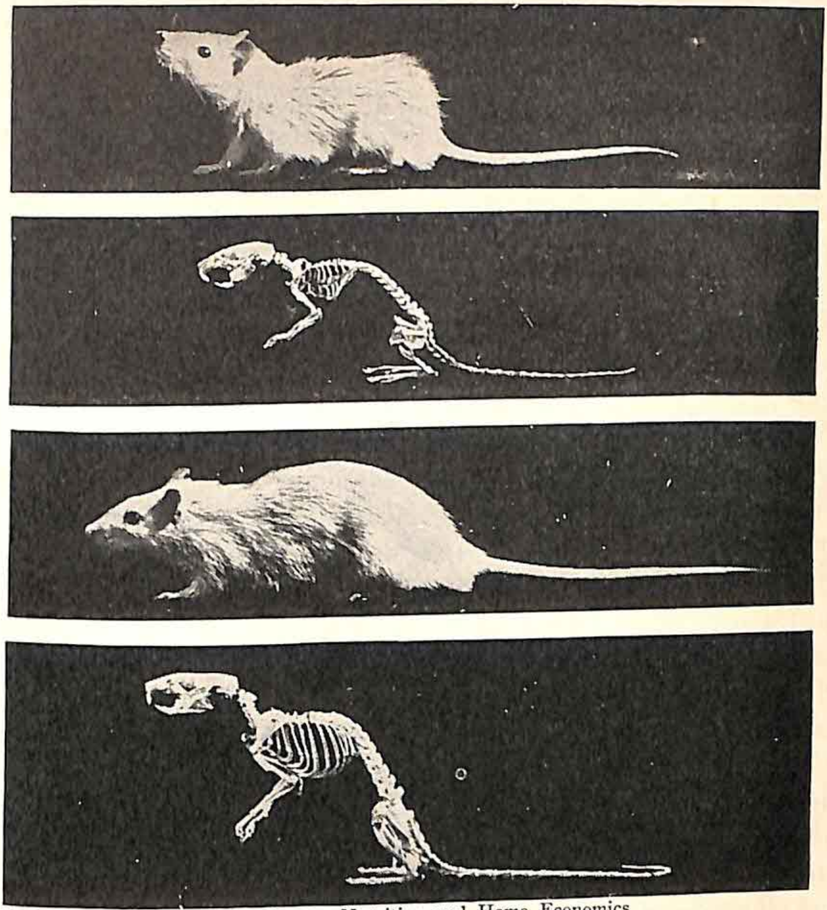
Other digestive ailments. *Heartburn,* so called because it irritates the lower end of the esophagus near the heart, is an upward movement of digestive juices in the stomach, sometimes combined with gas.

Nausea is a feeling of a need to vomit. It may be due to indigestion or may accompany severe headache; or it may be experienced (with or without vomiting) when riding in a train or in an automobile, as well as on board ship. It is sometimes due to eyestrain or may be one of the symptoms of almost any severe disturbance of the digestive apparatus. The milder forms of nausea may sometimes be relieved by taking a little bicarbonate of soda (baking soda) in water, or by applying external heat to the abdomen.

Ulcers occur chiefly along the upper or lesser curvature of the stomach and in the upper part of the duodenum (the beginning of the small intestine). Ulcers in the duodenum are more common than ulcers in the stomach. The causes are obscure, but digestive ulcers are now thought to be caused by frustrations and similar emotional tensions which affect the nervous and circulatory systems. There is usually an excess of hydrochloric acid in the stomach. Methods of treatment should be prescribed by a physician; they usually include rest, special diet, and sometimes remedial operations.

Decayed teeth and infected tonsils or sinuses may throw germs or poisons into the blood circulation and so disturb normal functions. Poor posture may cramp the digestive organs so that they act sluggishly. Worry or strong emotion, such as anger or fear, stops digestion for a time and may have an important effect on health.

Bad eating habits, such as swallowing food without sufficient



Courtesy U. S. Bureau of Human Nutrition and Home Economics

GROWTH may be controlled by diet. Food made the difference in these twin brothers, six months old. The rat in the top two pictures ate only meat, potatoes, bread, and butter. The rat in the bottom pictures ate plenty of milk and vegetables, besides meat, potatoes, bread, and butter. Note how much stronger and better formed his bones are than the bones of his brother.

chewing, cause many digestive ailments. Often these disturbances are only temporary, but unless the source of the trouble is recognized and the condition corrected, serious results may follow.

Allergy. Many foods, such as chocolate, strawberries, nuts, eggs, veal, chicken, or even wheat or milk, may cause an irritation or a rash to appear on the skin of certain individuals without any noticeable general effect on the system. Even though this rash lasts only a short time, it is usually an indication of a food to which the person is sensitive. Such a person is said to have an idiosyncrasy or abnormal sensitiveness called *allergy* for that particular food. If it is known what food causes the rash, this food should be avoided. Such food sensitiveness may be tested by skin specialists through special skin reactions which occur when the irritating foods are injected into the skin. A decision as to the real importance of such allergies is sometimes very hard to reach, even for a physician who is expert in this field of knowledge. Allergy may express itself in attacks of asthma, headaches, skin eruptions, or digestive discomfort.

Nutrition and weight. "How much do you weigh?" "I'm reducing." "How well you're looking; aren't you gaining weight?" These expressions or similar ones are often heard. They indicate a universal interest in body weight and its relation to health and appearance. While weight is an important factor in health, reliance cannot be placed on it alone as a standard for judging a person's well-being.

Standards of height and weight. Life insurance companies, clinics, and other agencies have established standards for height and weight at various ages. These standards are average conditions for the persons weighed, but do not set standards for health.

The weight of an individual should always be considered in relation to his age and build. Growing children should be a little over the average weight for their age and size. Adults past thirty should perhaps be a little under the average. Allowances should be made for physical types which vary from the average. Skeletal differences and racial and family inheritance all cause variations from the height-weight averages. In insurance, the relation of these factors to length of life is sometimes recognized by varying policy rates based on a sliding scale of 10 percent below to 20 percent above average weights.

A recent statement by the Metropolitan Life Insurance Company presents the conclusion that age is less important than body build in connection with weight. In other words, the trend seems to be to regard it as advisable to maintain a fairly uniform weight throughout adult life.

Factors which influence weight. A tendency to excessive underweight or overweight may be due to abnormal functioning of the ductless glands (see p. 294). These glands of the body pour into the blood secretions which seem to control the rate at which energy foods are burned in the body. If the rate is unusually slow, food is stored as fat. If the rate is excessively rapid, no food is stored and even body tissues may be consumed. Excessive overweight and underweight are usually accompaniments of unhealthy general conditions and should be investigated and cared for by the physician.

Overweight is sometimes an inherited characteristic. It may be caused by a sluggish functioning of the thyroid or the pituitary gland. More often overweight is caused by eating more food of certain kinds than is required by the person's activities. Or it may be that the amount of food is normal but that there is faulty assimilation by the body cells. In any case, the food eaten is out of balance with the use made of it in the body.

How to reduce weight. The chief need of the overweight person is to decrease the energy-food intake and to increase, by exercise, the energy output. When the body is practically at rest, a certain amount of energy is necessary to carry on body processes, such as digestion, circulation, and respiration. The daily basal requirement for an adult averages about 1,500 calories. The overweight person desires to burn up his own body fat, so his caloric intake must be reduced. He does this by using less of the fat, starch, and sugar foods. He lowers the amount of potatoes, bread, salad dressing, cream, butter, cream soups, and ice cream which he eats, but he does not omit such food completely.

If starches are eliminated entirely, fat foods will not burn completely and harmful acid substances are formed, increasing the hazard to health. The body needs all types of foods, as has been explained previously. A reducing diet should be a normal diet in range and quality but reduced in amount. Fats and starchy foods combined with fat—such as pastry, cake, and bread and butter—should be eaten sparingly. Non-starchy fruits and vegetables, which have a large quantity of cellulose, will satisfy hunger and produce a minimum of (stored) fat.

Courtesy H. Armstrong Roberts

YOUR HEALTH and strength are dependent upon the food produced on the farm.

A dangerous fad. Girls often mistake thinness for beauty. There is a difference between slenderness at normal weight and the scrawniness which comes with underweight. Persons who diet to reduce below the average normal weight run the risk of creating conditions unfavorable to health. With young people, especially, such action decreases resistance to ordinary colds and to pulmonary diseases. It prevents a general feeling of health and well-being. Those who diet for the sake of appearance alone are likely to lose not only their weight but their health and beauty as well. There are no magic reducing methods. Widely advertised drugs, baths, breads, waters, and other preparations are without merit, and some of them have been shown to be definitely harmful. Any attempt at reduction of weight should be under the supervision of a physician. In general, the physical condition will probably be better if weight is kept somewhat over average before the age of thirty and under average after forty years.

How to gain weight. The underweight person needs to build up his body tissues. To provide for the tissue lack in his body, he must carefully plan his diet. He must increase considerably the foods which will supply him with energy. The problem will be to secure the necessary number of calories and still to keep the food digestible and appetizing. Eggs, milk, cream, and butter will add calories to the diet. Generous amounts of starch and some sugar will help by the storage of fat. Calories, however, will not be enough. Sufficient amounts of fresh green vegetables and fruits must be included in order to provide vitamins, mineral salts, and roughage for proper elimination.

While diet plays a dominant part in increase of weight, the whole organism must be stimulated. Ample provision must be made for sleep and rest, so that fat may be stored. There must be exercise, but not to the point of using up the total amount of stored energy. Regularity of meals, unhurried eating, and thorough mastication will assist digestion and assimilation. Fresh air, sunshine, and avoidance of worry and nervous strain are also valuable assistants to diet in the storage of additional tissue.

In conclusion

IN THE digestive tract the food is ground and dissolved in readiness for absorption into the blood stream. The food does not release its stored-up properties until it has been absorbed from the digestive tract and has been carried to its final destination in the various parts of the body.

Activities

1. Chew a mouthful of dry, unsweetened cracker for two minutes. What changes in taste do you notice? What action does saliva have on starch?

2. Prepare a demonstration of osmosis. Hollow out a fresh carrot, fill with sirup, and close the top with a one-holed rubber stopper with glass tubing extending from the top. Secure the stopper tightly with sealing wax or paraffin. Submerge the carrot in water. How does the movement of the sirup up the tube explain absorption in the human body?

3. Demonstrate the action of saliva on starch; the action of gastric juice on protein in milk; the action of pancreatic juice on starch, fats, and protein. Consult the chemistry department for the chemical substances needed.

4. Write a story about Alexis St. Martin.

5. Prepare a report on Pavlov and his experiments on digestion.

Test

Directions: On a separate sheet of paper write the letters from A to K, corresponding to the letters of the practices given below. Place a check mark (√) to the left of the letters indicating the practices which you consider good. To the right of the checked letters place the numbers of the statements listed below which support the practices which you consider good. Do not write in the book.

Betty weighs considerably more than the other girls of her own height and age. Comparing her weight with that in the table of average weights, she finds that she is thirty pounds overweight, about one-third above the theoretical normal. She has been gaining in weight rapidly during the past year. What should Betty do to lose weight?

A. Drink very little water.
B. Decrease the carbohydrates and fats in her diet and increase the intake of protein.
C. Take a laxative salt and less carbohydrate food.
D. Take a medicine containing thyroid extract.
E. Take Turkish baths to induce sweating.
F. Determine her daily caloric requirement and then plan her meals so that the food intake is somewhat less than her normal caloric requirement.
G. Visit her family physician for a complete physical check up.
H. Take little exercise but limit the amount of food intake.
I. Exercise vigorously in the gymnasium for at least one hour daily.
J. Use a reducing belt.
K. Do nothing about her overweight condition.

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1. Baths which produce sweating cause a loss of weight by dissolving the fat.
2. Excessive drinking of water at and between meals will cause one to become fat.
3. Moderate exercise, such as walking, is of very little value in reducing weight.
4. An excess of carbohydrates and fats develop fat, while proteins are useful only in producing other kinds of tissue.
5. Overweight may result from poor elimination of food wastes, and reducing salts correct a faulty digestion.
6. Overweight is often due to abnormalities of the ductless glands.

7. Glandular treatment for reducing weight should only be taken after a physician's examination and under his supervision.
8. Some persons have a natural tendency to be fat, and any attempt to control this condition will endanger that person's health.
9. A natural tendency to gain weight can be controlled by practicing continual restraint as to the kinds and amounts of foods eaten.
10. Overweight is sometimes caused by eating more food of certain kinds than is required by the particular needs of the person.
11. Overweight is sometimes an inherited characteristic.
12. Rubber reducing belts shut off the supply of air to the part of the body they cover, causing the fat to melt away.

Associated subjects

Biology: Steps in the process of digestion. . . . Correct habits of eating. . . . Digestive process in other animals.

Chemistry: Action of enzymes on foods. . . . Nature of acids, bases, and salts. . . . Composition of "single sugars," "double sugars," and "many sugars.". . . Water, a solvent.

Home economics: Process of digestion. . . . Selection of foods for maintaining health and controlling weight.

Physical education: Relation of exercises to weight.

References

CARLSON and JOHNSON. *The Machinery of the Body.*
FISHER and EMERSON. *How to Live.*
GAUSS. *So You Feel Sluggish Today.*
GOLDBERGER and HALLOCK. *Health and Physical Fitness.*
GORRELL, MCKAY, and ZUILL. *Food and Family Living.*
MEREDITH. *Health and Fitness.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*

Films

Alimentary Tract. 12 minutes, sound. Encyclopaedia Britannica.
Digestion. 15 minutes, silent. Encyclopaedia Britannica.
Digestion of Foods. 12 minutes, sound. Encyclopaedia Britannica.

14. THE BLOOD TRAVELS IN A CONTINUOUS STREAM

FOR many hundreds of years it was believed that the heart was the center of the emotions. Traces of this belief still exist today. Such expressions as "I give my heart to you" and "the black-hearted villain" hark back to the Middle Ages. And Cupid still shoots his darts of love at the hearts of his victims.

The mystery of the circulation of the blood was solved by William Harvey in 1628. In his book on the movements of the heart and blood he published the main facts of circulation as we know them today. He showed that all the blood in the body moves in a continuous stream from a central source and back to it. This was one of the great discoveries in the history of medicine.

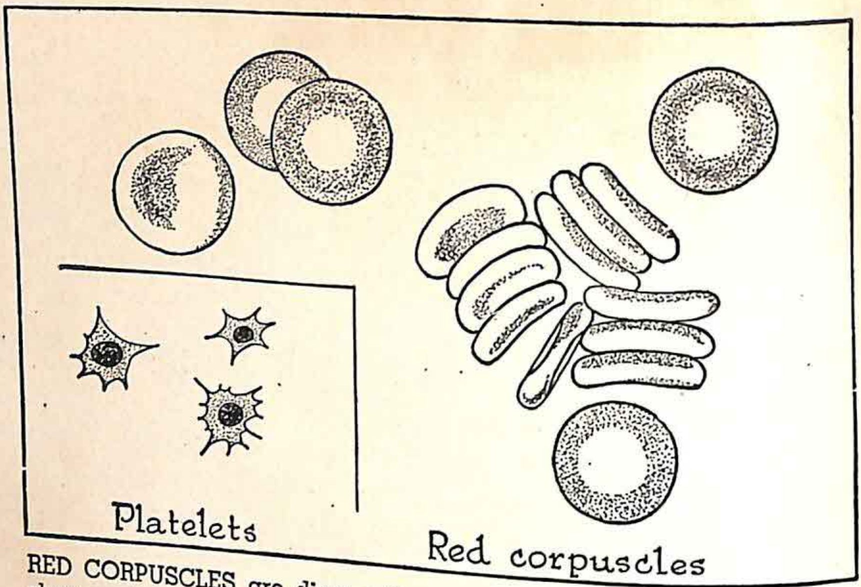
Do you know . . .

1. Why blood is essential to life?
2. What is meant by circulation?
3. What the composition of the blood is?
4. How the work of the red corpuscles differs from that of the white corpuscles?
5. How lymph differs from plasma?
6. What serum, hemoglobin, and fibrinogen are?
7. What pulse and blood pressure are?
8. How the heart acts as a pump?
9. How arteries differ from veins?
10. What capillaries are?
11. Why the blood must go to the lungs?
12. Why the ability of the blood to clot is important?
13. What pus is?
14. What anemia is?
15. What hardening of the arteries is?
16. What habits help keep the heart in a healthy condition?
17. Why blood transfusion is resorted to in a loss of blood due to accident?
18. What blood banks are?

The blood. Blood makes up about one-thirteenth of the body weight, there being five or six quarts in a person of ordinary size (150 lbs.). It is distributed in such a way that about one-fourth is always in the heart, lungs, arteries, and veins; one-fourth in the liver; one-fourth in the muscles; and one-fourth in all the other organs. The blood consists of a liquid in which floats an enormous number of minute, solid bodies. The liquid is called *plasma,* and the solid bodies are of three kinds: red corpuscles, white corpuscles, and platelets.

Blood plasma. The plasma is a transparent liquid of a light straw color making up about one-half of the blood. It is the clear fluid left after the solids have been removed from the blood. Ninety percent of the plasma is water which carries in solution foodstuffs, carbon dioxide, inorganic salts, and waste substances. Its chemical composition varies somewhat in the different parts of the body, as well as in cases of disease. The foodstuffs or nutrients enter the blood stream from the intestine, the waste products from various parts of the body. The plasma also contains special blood proteins, chemicals (hormones) from the ductless glands (see p. 294), and certain substances which help the body to resist disease (see p. 387).

The blood cells. The red cells or *red corpuscles* (meaning little bodies) are wheel-shaped, slightly hollowed on both sides. They are the most numerous of the blood cells, a drop of blood about the size of a pinhead containing over 5,000,000 red cells. The redness characteristic of blood is not evident in a separate corpuscle, which has a light straw color. The color is due to an iron compound called hemoglobin, which is able to combine with the oxygen from the air in the lungs and to carry it in the blood stream to all the tissues in the body. If a large amount of oxygen has been absorbed, the hemoglobin is a bright crimson red. When the oxygen is withdrawn, the hemoglobin has a darker tint. The chief work of the red corpuscle is to carry oxygen to all parts of the body. The red cells are formed in the red marrow of certain bones. It is believed that when worn out they are destroyed in the spleen and liver. The spleen is a dark red oval organ near the lower wall of the back of the stomach on the left side of the body.

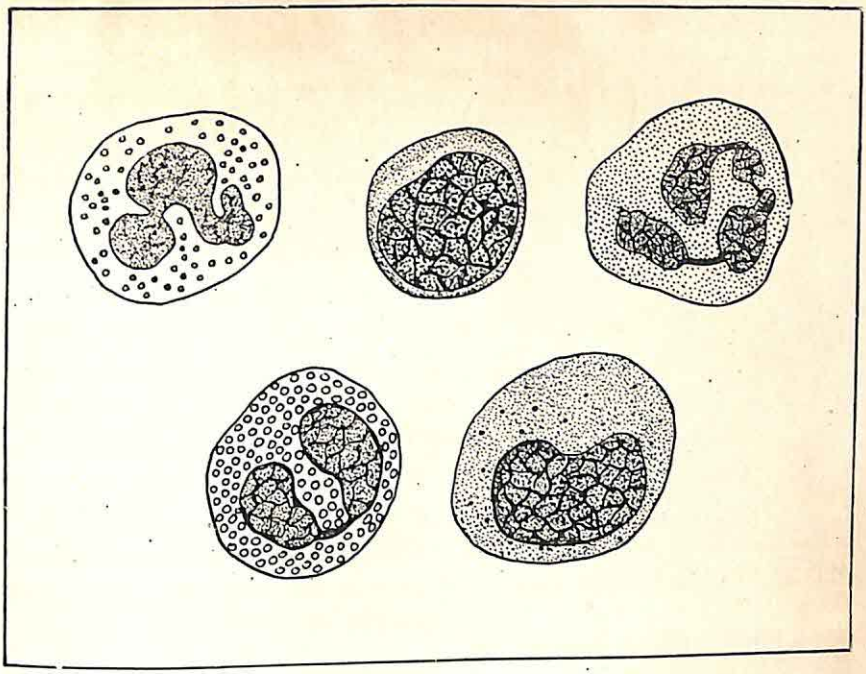


RED CORPUSCLES are discs with concave surfaces. In profile, they show a dumbbell shape. Blood platelets are fewer in number and much smaller than red corpuscles.

In the case of carbon monoxide (automobile exhaust gas) poisoning, the red corpuscles have combined with this gas so that they do not have capacity for carrying oxygen (see p. 209).

The colorless cells or *white corpuscles* are about one-third larger, but less numerous, than the red corpuscles, there being one white corpuscle to every six or seven hundred red ones. They can change shape, move through the thin-walled blood vessels, and penetrate to all parts of the body. There are several kinds of white corpuscles. Certain white cells protect the body against the invasion of bacteria, being ready to surround and digest bacteria that may get in through wounds in the skin and mucous membranes. Other white cells have functions that are not yet well understood. Pus is composed of dead and living white corpuscles which have come together to attack invading bacteria at a certain spot. It is not clearly understood where all the white corpuscles are formed. As far as is known, they arise mainly in the lymph nodes and the bone marrow.

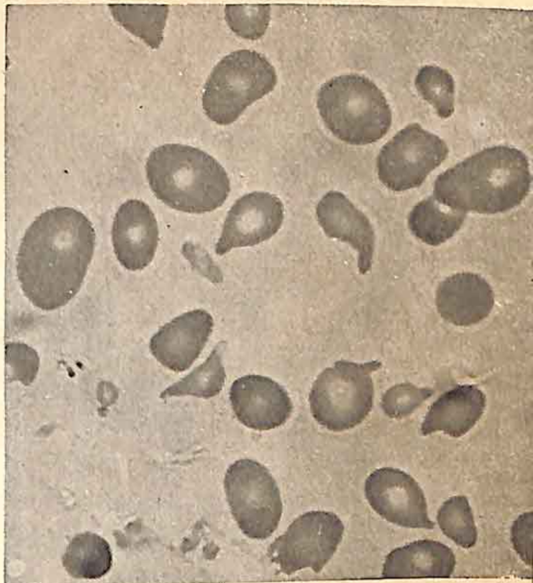
The blood platelets are extremely small. In diameter they are only one-third as large as the red blood cells. They are believed



THERE ARE several kinds of white corpuscles. The irregular body in each cell is the nucleus which varies in shape according to the kind of corpuscle. Some white corpuscles also contain granules in their cytoplasm.

to have a part in the clotting of the blood and to be formed from certain large cells in the bone marrow.

Clotting of the blood. Everyone is familiar with the fact that cuts and bruises usually stop bleeding after a few minutes. One of the special blood proteins in the plasma is *fibrinogen,* which causes the blood to clot. When the blood leaves the blood vessels, the fibrinogen is changed to fibrin, long strings of protein material which entangle the blood cells. While the blood clots, a clear, yellowish liquid called *serum* is being formed. There are several theories concerning the formation of the clot. According to one theory fibrinogen is changed to fibrin by an enzyme (ferment) in the blood whose activity is held in check until needed. Certain conditions have to exist before fibrin can form. A wound injures certain cells, and this makes them give out an enzyme. The blood platelets when exposed to the air give out mal state in which the balance between the formation of new cells and the destruction of old cells is disturbed.



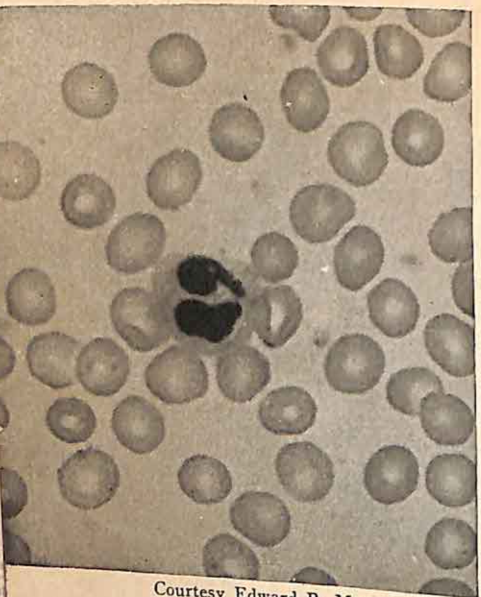
Courtesy Edward R. Mugrage, M.D.

NOTICE how different the red corpuscles appear in the blood of a person with primary (pernicious) anemia. (See p. 212.)

One type of anemia is the result of an excessive loss or destruction of red blood cells. This loss may be caused by a large hemorrhage or by slow bleeding. About one-fourth to one-third of the blood of the body may be lost without fatal result. The bone marrow is able to replace this loss in from one month to six weeks. Slow, repeated, small hemorrhages, as in hookworm infection, may cause secondary anemia quite as readily as a single large hemorrhage. The red cells are destroyed in certain diseases, such as malaria, and also when the spleen becomes greatly enlarged. This rapid loss of red cells through the spleen is treated by surgical removal of the organ.

In another type of anemia the bone marrow is defective. Certain chemicals are more or less destructive of bone-marrow tissue. This disease may occur among industrial workers.

Normal bone marrow cannot manufacture red blood cells if the body is deficient in iron. In the human body the iron from the old, worn-out cells can be used over again to make new ones. But this is not enough iron, so foods must be depended upon as an additional source. Poorly selected diets which lack iron are the cause of nutritional anemia. This type of anemia is often found among infants whose food is entirely milk. Milk, otherwise an excellent food, is very poor in iron. There is also danger of this disease during adolescence, particularly among girls. It may occur in women during pregnancy. Protein deficiency and



Courtesy Edward R. Mugrage, M.D.

THESE ARE red corpuscles of normal blood, with one white corpuscle, enlarged 1,000 times. The smallest spots indicate blood platelets.

the same kind of enzyme as wounded cells do. This enzyme sets the blood-clotting enzyme free. Calcium in the blood joins with the enzyme and makes it able to change fibrinogen to fibrin, and so a clot is formed.

Hemophilia is a condition in which the blood fails to clot within a very few minutes. A person afflicted in this way is likely to bleed profusely at the slightest injury. This is a hereditary disease (see p. 323) affecting only male members of the family and transmitted only by female members. It always skips a generation, since mothers transmit it only to sons, and sons who are affected cannot transmit it to their children. Normal serum (from other humans or from horses) may be injected to control bleeding. Vitamin K may also be used.

Anemia. A condition known as anemia may develop if the hemoglobin is inadequate in amount. In such a case the blood may not have enough red corpuscles, or each red corpuscle may not have sufficient hemoglobin to carry the necessary supply of oxygen to the cells of the body. Thus cell oxidations are hindered, and not enough energy is liberated. Muscles fatigue quickly, and, if anemia is severe, the muscles may be very feeble. An anemic person is likely to be pale and to tire easily. Anemia often exists in young and growing girls. It is important to determine, if possible, the cause of the reduction in the amount of hemoglobin in the blood and to try to remedy that cause.

In a healthy person, from one-tenth to one-thirtieth of the red cells are destroyed daily by the spleen and the liver and new ones are formed in the red marrow of the bone. Anemia is an abnorlack of vitamin C in the diet may also cause defective blood formation.

In primary or pernicious anemia the red cells vary greatly in structure. The bone marrow is defective and produces cells that are large, small and fragmentary, or immature. For a long time pernicious anemia was always fatal. Within recent years it has been found that administering liver or liver extract to the patient brings the blood count up to normal. The liver treatment does not remove the primary cause of the disease, and its use must be persisted in for the rest of the patient's life. Evidence is available to indicate that pernicious anemia is partly dietary and partly due to a defect of the stomach. Dried hog stomach is now used as an alternative to liver or liver extract.

Blood transfusion. Sometimes in great loss of blood from bleeding, or in certain diseases, lives are saved by blood transfusion (passage of blood from one person into another through opened veins).

In the older method of transfusion a direct connection and passage of blood was made between a vein of the patient (the recipient) and an artery of the person giving his blood (the donor). This was superseded by the syringe method, in which blood is drawn from a vein of the donor by means of large, all-glass syringes and injected into a vein of the patient. This transfusion is carried out before the blood has had time to clot. Four distinct types of human blood are recognized. Transfusion can only be completely successful when the red blood cells of the donor are not agglutinated or destroyed by the blood of the recipient. These injurious effects are avoided by using a donor whose blood is of the same type as that of the patient.

Blood banks. Healthy people may safely donate blood. They customarily give one pint, which is taken from the arm vein into a sterilized vacuum bottle. The bottles contain an anticoagulant (sodium citrate) and some preservative solution so the blood may be refrigerated and kept for about three weeks in a stable condition. It can be used for transfusions during this time. There are four main types of blood; the proper type must be used for every transfusion. In addition to whole blood, some banks are preparing and distributing blood plasma.

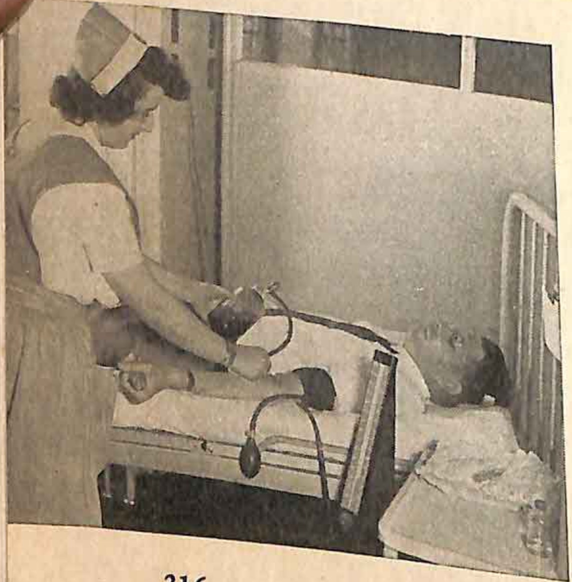
Stored blood plasma. In World War I severely wounded men were given direct arm-to-arm transfusions of blood. On the battlefield transfusion of whole blood is difficult, dangerous, and usually impracticable. In World War II a safer method of replacing blood volume was used.

Nearly every severely wounded person, even without actual loss of blood through an open wound, suffers from a condition known as "shock." In such an injury plasma flows from the blood vessels into the damaged tissues. Unless a sufficient amount of liquid can be injected promptly, the injury may be fatal. The introduction of plasma into a blood vessel restores the volume of liquid, and also helps to bring back fluid which has escaped into the tissues. Thus an injured man can be kept alive for hours, and during this time it may be possible to take him to a hospital.

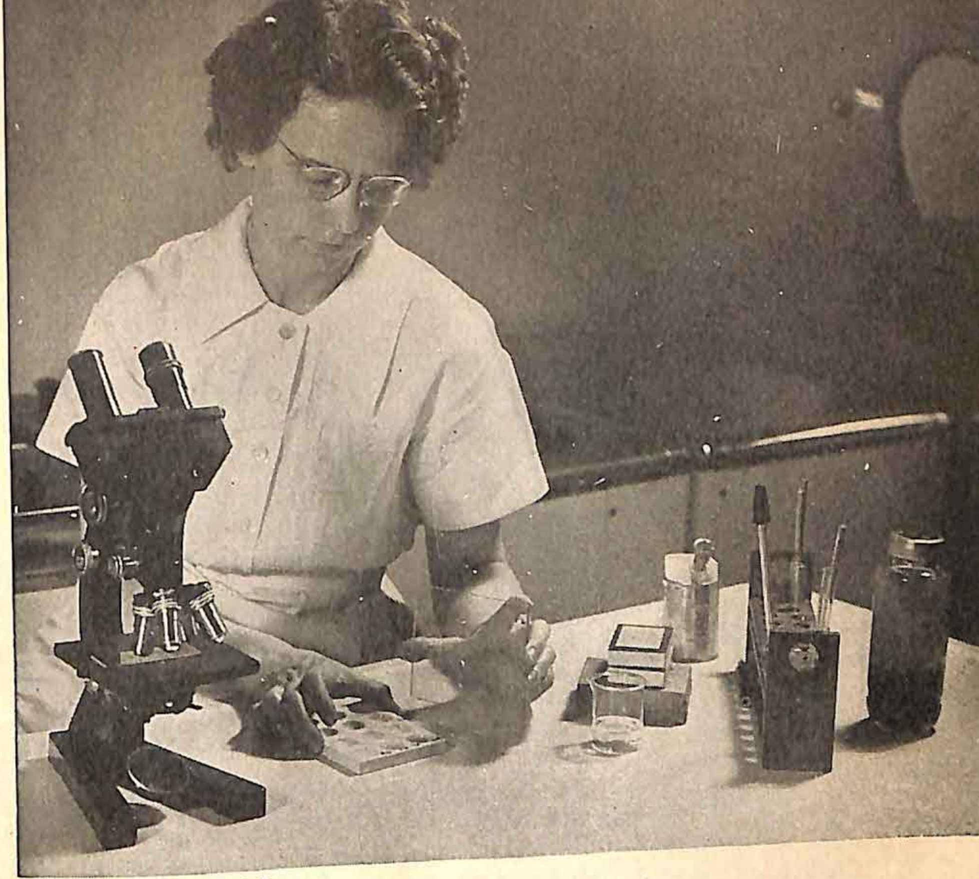
Since the composition of plasma is uniform, anybody's plasma may be safely put into any other person's body under the necessary surgical precautions. In order that the plasma may be obtained, the whole blood drawn from the arm of a "donor" is whirled rapidly and in a circular fashion (centrifugally), in a machine called a centrifuge. The solids of the blood settle at the outer end of the whirled tube, and the liquid plasma can be drawn off from the top of the tube after it stops whirling. The liquid may then be either frozen or dehydrated. If dehydrated, the powder that remains is kept in sterile, vacuum-sealed bottles. To restore the dried plasma to liquid form, distilled water is added. Plasma injections are often only stop-gaps until whole blood can be given. Blood and plasma banks keep ready for immediate use whole blood and both liquid and dried plasma.

The blood stream. As it moves through the body, the blood carries to all the cells food from the small intestine and oxygen from the lungs. It removes waste from the tissues and carries it to the organs of excretion—the lungs, skin, and kidneys. It aids in keeping the temperature of the body uniform by flowing from warmer or active parts to cool or less active parts and from the cooler external surface to the warmer internal areas. The blood keeps all parts of the body bathed in liquid (lymph). It provides a defense against bacteria. It also distributes the secretions of the glands which control growth and development.

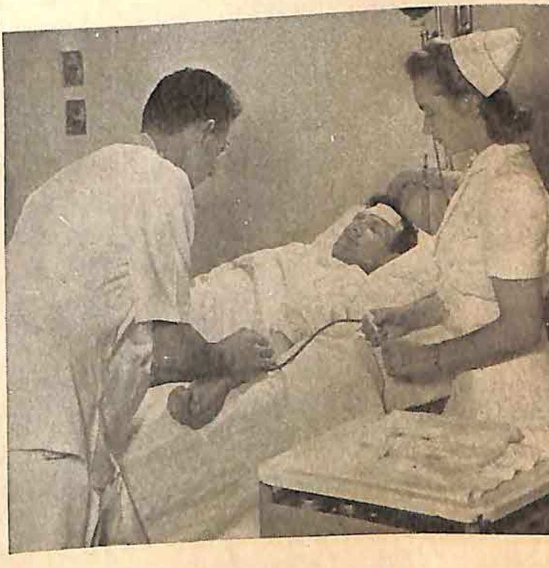
Courtesy Belle Bonfils Blood Bank, Colorado General Hospital, Denver, Colorado



THESE FOUR pictures portray the story of taking that precious substance—blood—from a well person and giving it to a sick one. This is a common procedure now in medicine. The donor is checked first to make sure he is in good health. A drop of blood is taken from a finger to test for anemia. Then, while the donor lies down for a few minutes, the skin over the vein in the arm is made sterile and anesthetized. A needle is painlessly placed in the vein and blood is drained into a special bottle.

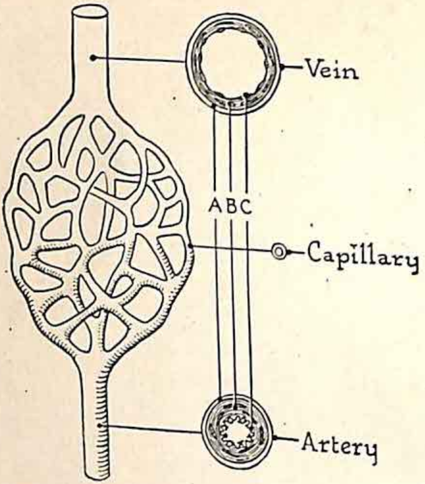


Courtesy American Red Cross



BEFORE THIS blood can be used safely as a transfusion, it must be tested carefully and typed. There are four main types of blood. In addition to being typed, the blood must be checked for other qualities, such as its Rh factor and others. Before being used for a transfusion, blood must be proven compatible with that of the patient. The third picture shows this testing. In the fourth picture a sick person is receiving a blood transfusion through a vein in the arm.

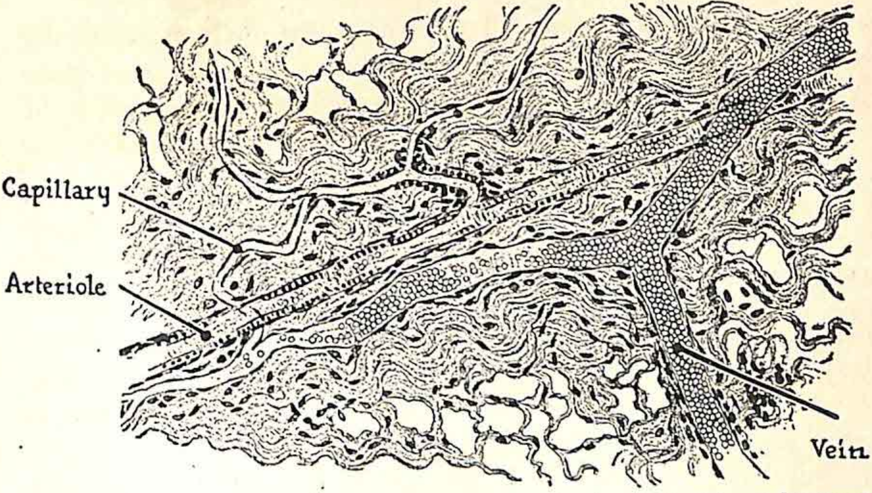
The circulatory system. To serve its various functions, the blood must be kept in motion. It travels through a continuous system of tubes which begin and end at the heart. The heart is the pump which maintains the constant flow. The circle of flow is called the *circulation* because the blood is sent out only to return again and again. The blood vessels vary in size from the diameter of a man's thumb to microscopic size. There are three kinds of blood vessels: arteries, capillaries, and veins.



THE STRUCTURE of a vein and an artery are compared in this diagram. *A* shows the outer coat of elastic fibers and supporting tissue. *B* indicates the middle coat of elastic muscle fibers; and C shows the inside elastic coat with thin flat cells. How does an artery differ from a vein?

Arteries. The vessels which carry blood away from the heart are called arteries. These have strong elastic walls consisting of three layers. The inside coat is a thin, smooth membrane; the middle layer is made up of muscle and elastic fibers; and the outer coat consists of loose connective tissue. The elasticity of the arteries permits them to stretch and respond to the changing demands of pressure in the circulation. The muscles control the supply of blood to a given region. As people grow older, the walls of the arteries usually become less elastic. This condition, which also occurs from disease in some middle-aged people, is known as *arteriosclerosis* or "hardening of the arteries" (see p. 307).

The largest of the arteries is the aorta, which receives blood from the left side of the heart, and divides into smaller and smaller vessels so as to carry blood to all parts of the body. The next largest is the pulmonary artery, which receives blood from the right side of the heart and carries it to the lungs to receive



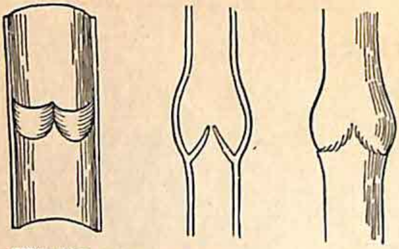
NOTE THAT this capillary arises from a branch of an arteriole and passes under the arteriole to enter the tributary of a small vein. The capillaries convey blood from the arteries to the veins and usually form a network in the tissue.

oxygen and give up carbon dioxide. The small arteries are called *arterioles.*

Capillaries. The capillaries are microscopic, thin-walled tubes which form a network connecting the smallest arteries with the smallest veins. Many of these vessels are so small as to permit the passage of only a single line of red corpuscles. They are so thickly distributed throughout the body that one cannot press the point of a needle through the living flesh anywhere without puncturing one of them. The walls of the capillaries have only one layer of cells and are so thin that materials such as oxygen and dissolved foods can pass through them easily.

Veins. The vessels which return blood to the heart are called veins. Their walls are thinner, less elastic, and less muscular than those of the arteries. Within certain veins there are valves which resemble pouches. Valves are especially numerous in the vertical veins of the arms and legs, where they aid the upward passage or flow against gravity.

Varicose veins are veins in which the valves have become ineffective and the walls have stretched. This results in a slowing up of the circulation in the part involved. The wearing of tight



THESE PORTIONS of veins show how the valves operate. On the left, the vein is laid open; on the right, the valve is closed.

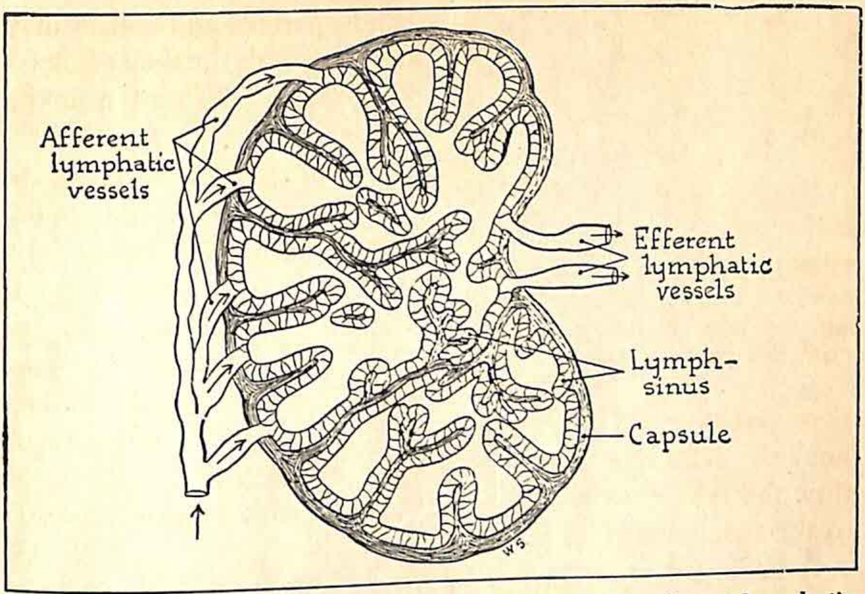
bands, garters, and collars may interfere with the flow of blood in the veins which are near the surface.

Lymph. As the blood circulates through the capillaries, the liquid plasma with some of the white corpuscles oozes through the thin walls of these tiny vessels. It finds its way as tissue fluid or *lymph* into the minute tissue spaces and bathes all the cells of the body. From the tissue fluid the cells receive energy, food, and oxygen. At the same time the cells give up carbon dioxide and other waste products to the tissue fluid.

A small part of the tissue fluid passes back through the walls of the blood vessels, but most of it does not. This remaining fluid from the blood is returned to it through a second system of vessels called the lymphatic system.

Plasma from the capillaries enters the spaces between the cells faster than the tissue fluid passes back into them. So the tissue fluid is slowly forced from the spaces into the small tubes of this second system of vessels, the lymphatics. The tissue fluid, after it enters the lymphatics, is called *lymph*. The smaller lymphatics lead into larger ones and these finally into tubes which empty into the veins of the chest (thorax). The lymph is kept moving by the action of body muscles. This compresses the lymph spaces and lymph vessels. Valves in the lymphatics similar to those in the veins help the lymph to flow toward the points where it enters the blood stream. There is no heart to propel the lymph. Exercise helps to keep it from stagnating in the vessels.

Lymph glands. Scattered along the course of the lymph vessels are small oval-shaped bodies called lymph glands. They are not true glands but consist of a loose network of fibers in which are cavities filled with lymph. They are also spoken of as *lymph nodes*. There are many in the neck and under the jaw. Larger groups occur in the armpits and in the groins. The lymph nodes

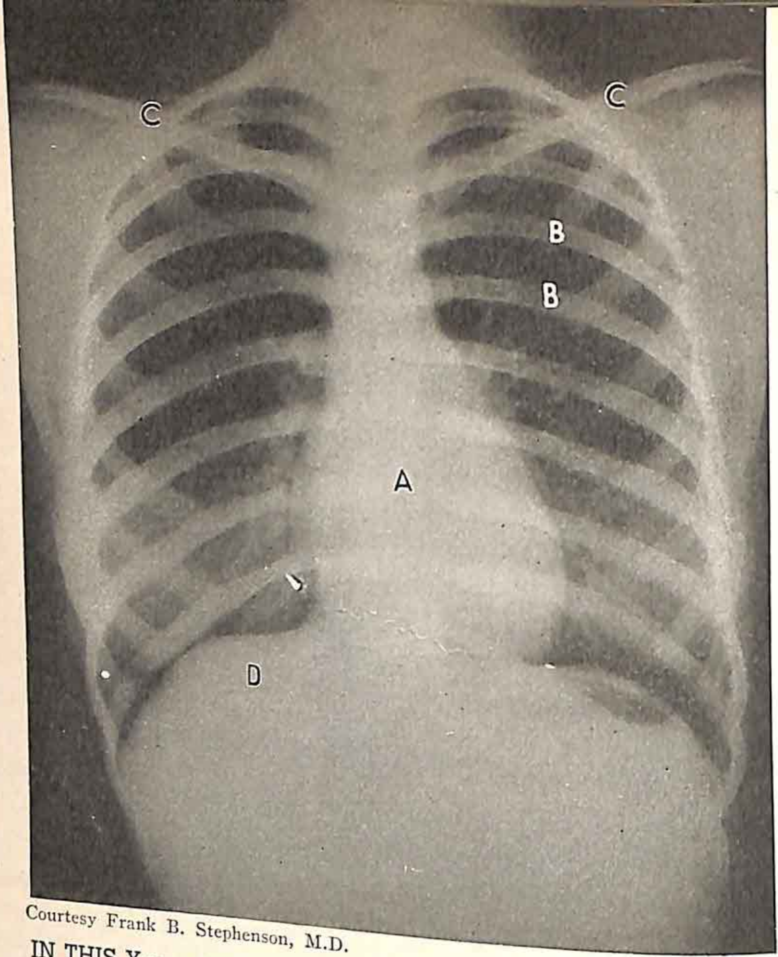


WHAT is the difference between the afferent and the efferent lymphatic vessels as shown in this enlarged diagram of a lymph node?

act as filters removing harmful bacteria and solid impurities from the lymph. Sometimes they become inflamed if the white corpuscles cannot keep up with their work. For example, if the tonsils or teeth are infected, glands of the neck or jaw may appear as painful swellings under the skin.

The heart. The human heart is a hollow muscular organ located in the chest cavity, between the lungs, just behind the breastbone. Two-thirds of the heart lies to the left of the median line of the body and one-third to the right. It is about the size of one's closed fist. The small end (apex) normally points downward toward the left side of the body. The heart is surrounded by a double walled bag of rather thin tissue, the *pericardium*. Between the two walls is a fluid which lessens the friction caused by the beating of the heart.

The heart may be regarded as two pumps, placed side by side, and both acting at the same time. Each pump has two chambers: the upper, called the *auricle,* and the lower, the *ventricle*. The auricles receive blood from the veins. The ventricles pump blood on—the right ventricle, into arteries which carry blood to the



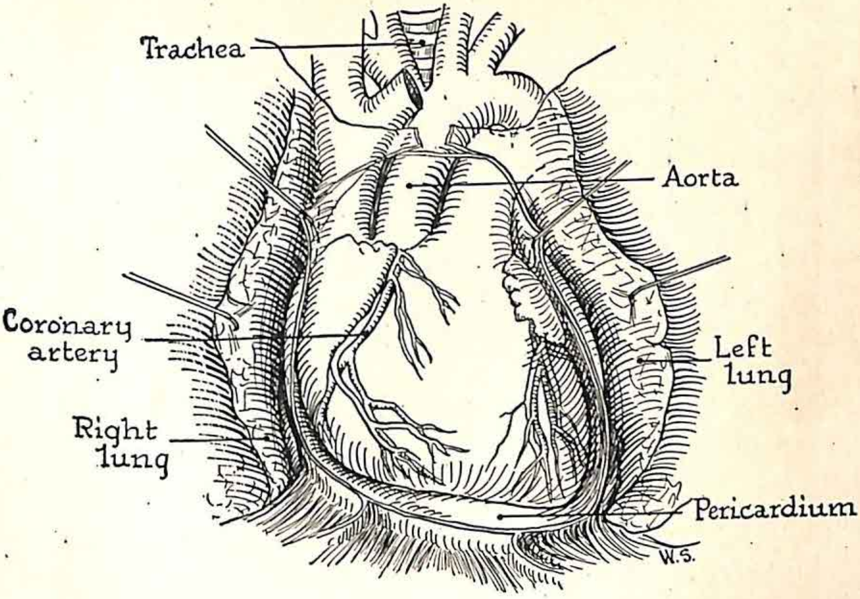
Courtesy Frank B. Stephenson, M.D.

IN THIS X-ray picture of the chest *A* shows the heart; *B*, the ribs; *C*, the collar bone, or clavicle; and *D*, the position of the diaphragm.

lungs; the left ventricle, into arteries which distribute blood everywhere else in the body.

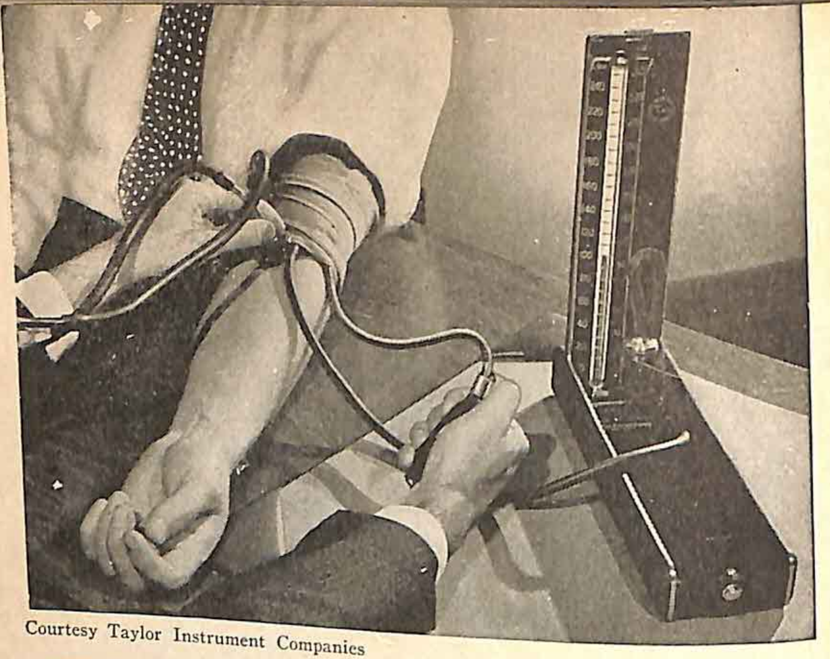
All force pumps have valves which permit the liquid to go only in one direction. In the heart the valves are small, delicate leaflike structures that are easily injured. In order that the heart may produce a vigorous impulse, the valves must fit tightly and the muscles of the wall must be strong. The heart muscle is supplied with blood by special arteries, the *coronary arteries*.

The pulse. The heartbeat is caused by the action of the heart muscles. The muscles contract; then relax. This is followed by a very brief period of rest lasting only a fraction of a second before the movements are repeated. The heart pumps at the rate of seventy-two to eighty times a minute. The *pulse* is the periodic swelling of an artery resulting from the heart's action. It shows the frequency and regularity of the heartbeat. It can be located wherever an artery is sufficiently close to the surface to be felt by the examiner's finger. In suitable light it can be seen at the neck, the temples, the inner side of the arms, and at the wrists.



IN THIS picture the lungs have been turned back to show the heart and the blood vessels connected with it. Special arteries supply the heart muscle with blood.

Blood pressure. The blood in the vessels is under a certain pressure, called the *blood pressure,* that varies according to the force of the heart and the size and position of the vessels, as well as the stage of the pulse cycle—that is, whether the heart muscle is contracting or relaxing. The pressure is greatest in the arteries, intermediate in the capillaries, and least in the veins. Taking the blood pressure is one of the routine details of a general medical examination. For medical purposes the blood pressure is usually measured above the elbow with a special apparatus which has a



Courtesy Taylor Instrument Companies

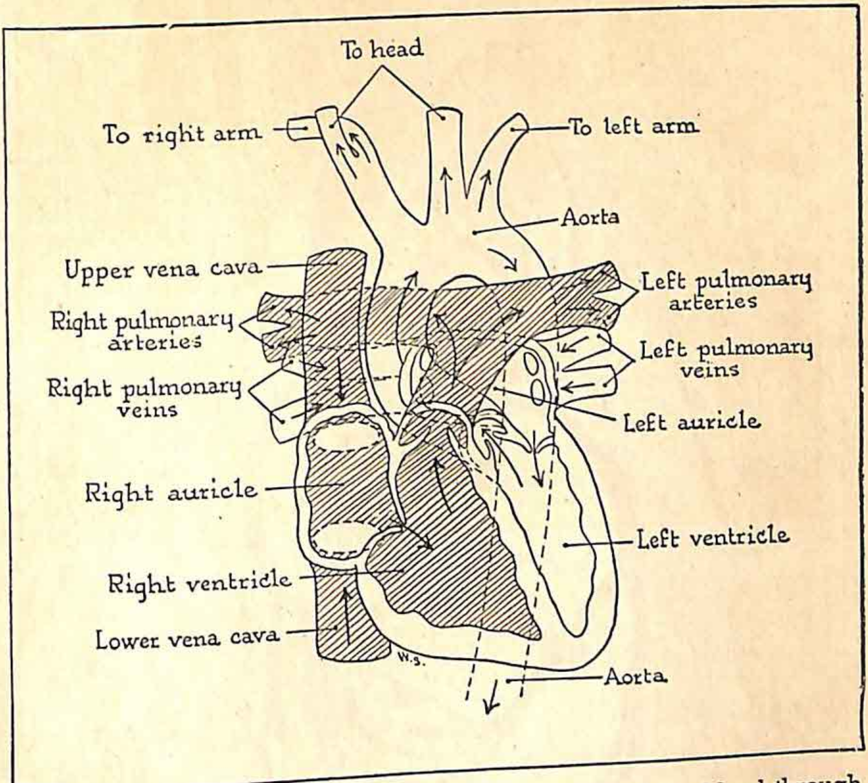
ONE OF THE means by which a physician is able to determine a person's physical fitness is by taking his blood pressure.

tube filled with mercury. The pressure is recorded in millimeters of mercury, to show how high a column of mercury the blood pressure can support.

The pressure of the blood within the arteries varies with each individual as a result of meals, baths, emotion, violent exercise, whether he is sitting or standing, and other factors. Normally the blood pressure of children is less than that of adults, the pressure of women less than that of men, and the pressure of girls less than that of boys.

Circulation of the blood. The blood from all parts of the body except the lungs is collected in two large veins which empty into the right auricle. When the right auricle contracts, this blood is forced into the right ventricle through a valve which separates the right auricle from the right ventricle.

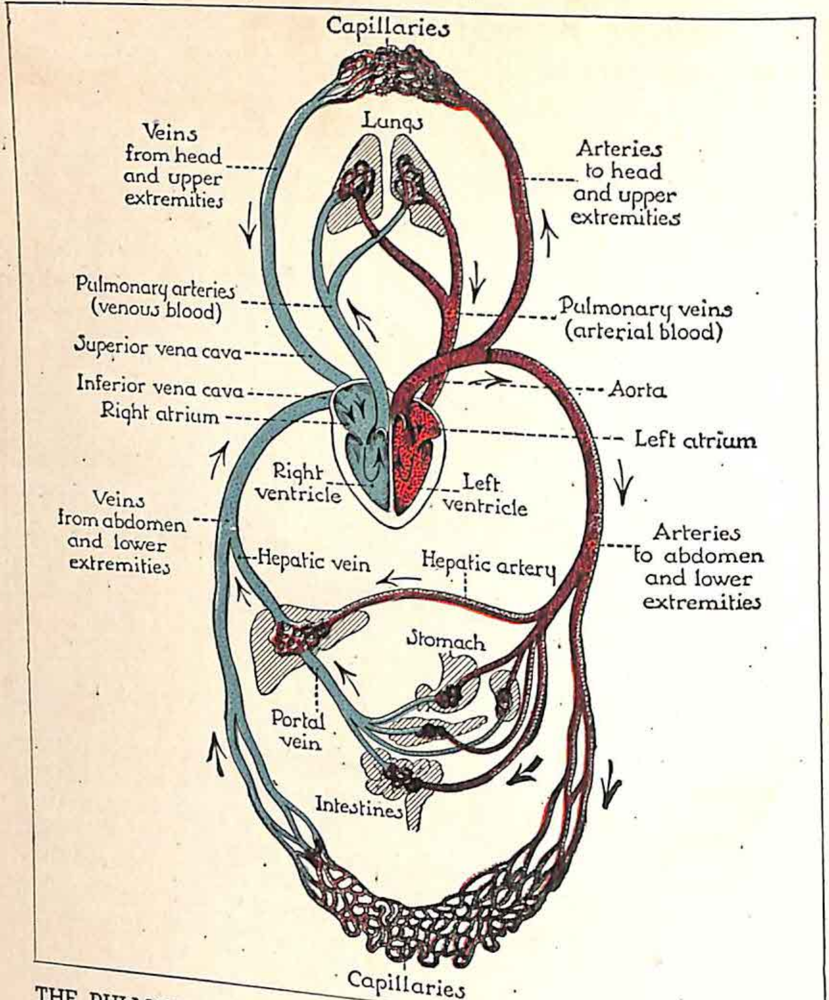
When the right ventricle contracts, the valve between it and the right auricle closes and the blood is forced through another valve into the pulmonary artery. The pulmonary artery carries the blood to the lungs, where it passes into capillaries which spread



THE ARROWS in this diagram indicate the course of the blood through the heart. Blood coming from the lungs, shown by the unshaded area, carries a new supply of oxygen and a small amount of carbon dioxide. The other blood, shown by the shaded area, has given up much of its oxygen and taken up carbon dioxide. The flaps in the upper parts of the ventricles and at the beginning of the pulmonary artery and the aorta are valves which prevent the backward flow of the blood.

out over the walls of the air sacs. Here the blood gives up its carbon dioxide and takes up oxygen. After this exchange of gases, the blood is collected in small and then larger veins which finally unite to form the pulmonary vein. This very large vein empties its blood into the left auricle. The circuit of the blood from the heart to the lungs and back to the heart is the lesser or *pulmonary* circulation.

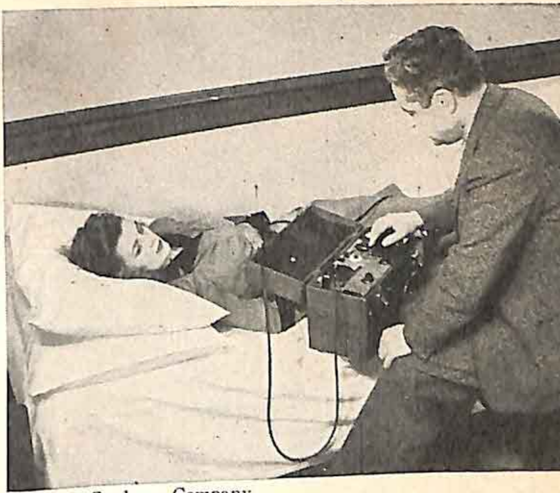
When the left auricle contracts (at the same time as the right auricle), the blood is forced into the left ventricle through a valve which separates the left auricle from the left ventricle. When


Capillaries
Lungs
Veins from head and upper extremities
Arteries to head and upper extremities
Pulmonary arteries (venous blood)
Pulmonary veins (arterial blood)
Superior vena cava
Inferior vena cava
Aorta
Right atrium
Left atrium
Right ventricle
Left ventricle
Veins from abdomen and lower extremities
Arteries to abdomen and lower extremities
Hepatic vein
Hepatic artery
Stomach
Portal vein
Intestines
Capillaries

THE PULMONARY circulation includes the pulmonary artery, capillaries of the lungs, and the pulmonary veins. The systemic circulation includes all the other arteries, capillaries, and veins of the body. The portal circuit carries blood from the intestines and other digestive organs through the liver.

the left ventricle contracts, the valve between it and the left auricle closes; and the blood is forced through another valve into the aortic artery, usually called the *aorta*. The aorta branches into smaller and smaller arteries, and these arteries finally break up into capillaries. This marks the end of the journey of the blood away from the heart and the beginning of its return journey. From the capillaries the blood flows into small veins, and so back, through the two largest veins, into the right auricle. The circuit from the heart to all parts of the body and back to the heart is the greater or *systemic* circulation.

There is a third circuit of circulation beside the pulmonary and the systemic circulations which have just been described. This third circuit is the *portal* circulation, which takes the blood from the intestines through the liver before delivering it to the right auricle. It is really a partial detour (branch) of the systemic circulation.



Courtesy Sanborn Company

THE ELECTROCARDIOGRAPH records electrically, by tracings on a moving drum, the muscular action of the heart, thus showing whether the action is normal or abnormal.

Injuries to the heart. Injury to the valves of the heart is due to infectious diseases. Bacteria of these diseases, carried in the blood, may scar and deform the heart valves. Acute rheumatic fever, scarlet fever, tonsillitis, and pneumonia are the most dangerous in this respect. Infected teeth may sometimes cause an injury to the heart in the same way.

After a prolonged sickness the heart is weakened through poisons from the disease and from the inactivity of the body. Complete rest in bed during tonsillitis, "flu" (influenza), or rheumatism is important. While convalescing, the patient should begin an active life gradually. Strenuous exertion before the heart has recovered its tone may be disastrous.

The use of certain drugs in self-treatment of colds and headaches may be decidedly injurious to the heart (see p. 354).

Rest is important in helping the heart to build up reserve power.

The heart has enormous powers of adjustment, both to the needs of the body and to the inroads of disease. It is usually capable of doing more work than it is at any moment accomplishing. However, there are two exceptions. When the body is under maximum exertion, as in fast running or mountain climbing, a point will be reached when the heart, in its effort to supply the body with blood containing oxygen, is doing its utmost. In such circumstances it occasionally happens that the heart muscle gives way by stretching, and we have acute dilatation of the heart, which may prove fatal. Disease of the heart muscle, or loss of elasticity of the walls of the arteries, will also reduce the heart's power of adjustment.

Failure by the heart to pump the necessary amount of blood per minute is serious. Some of the causes are leakage through a valve, which wastes the heart's efforts; excessive resistance to the flow of blood by diseased arteries (high blood pressure); and interference with the blood supply of the heart. In either case—whether deformed heart valves or high blood pressure—the heart has to do more work at each beat in order to keep the full amount of blood in circulation. A form of heart disease called *coronary thrombosis* is caused by a chronically diseased condition of one or more of the coronary arteries, the vessels supplying blood to the heart muscle. The passage through the artery becomes narrower and finally the circulation is cut off by a blood clot. Coronary thrombosis kills a great many people after middle life. Further discussion of diseases of circulation will be found in Chapter 20.

Health and the blood stream. Poor posture may interfere with circulation. Lack of exercise results in poor muscle tone, which means weak abdominal muscles, as well as a weak heart muscle.

Adequate systematic exercise, suited to the age, mode of living, and physical condition of the individual, is important.

A well-controlled nervous system is important, since the action of the heart is influenced by nerves.

All forms of excess—physical, mental, and social—should be avoided. Poisons, such as alcohol, tobacco, and some pain-killing drugs, tend to injure the heart muscle.

Wholesome diet, rest (including adequate sleep), sunlight, and outdoor living are beneficial at all times, subject to the avoidance of excessive sunburn and of undue exposure to cold and dampness.

In conclusion

THE heart and blood vessels are fundamental organs because of the dependency of the other organs of the body upon the circulation of the blood. The blood which travels in a continuous stream through the body carries oxygen and food necessary for work and growth. It also picks up wastes that must be eliminated from the body. The blood vessels are hollow muscles that can respond to pressure, and the muscular heart, by its rhythmical contractions, drives the blood through these vessels. The heart muscle is also supplied with blood to do its work. Like all other parts of the body, these organs are subject to injury and disease.

Activities

1. Study blood under the microscope. Prick your finger with a fine sterilized needle and place a small drop of blood on a slide. (Before pricking the finger, wipe it with alcohol and sterilize the needle with alcohol or by passing it through a flame.) Place a cover glass on the blood and examine it with the low and then the high power of the microscope. The tiny bodies floating in the liquid are red corpuscles. If the slide is not prepared quickly, the red cells may lose water and appear rough and knobby. Look for any trace of a shadow that might indicate the hollowed or concave surface of each corpuscle. Here and there a corpuscle has a somewhat silvery appearance. This is a white corpuscle. Note that the red corpuscles tend to group themselves one above another resembling piles of coins.

2. Obtain from the butcher a beef heart. Note the shape and color of the heart, the fat imbedded in the walls, and the blood tubes leading to and from the heart. How do the arteries differ from the veins? Force water into the ventricles until the valves leading from the auricles are closed. Cut the heart open lengthwise and locate the four chambers. Which chamber has the thickest walls? Locate the valves between the auricles and ventricles. Look for cords that attach the valves to the wall of the ventricle. Explain the action of the valves.

3. Determine the effect of exercise on the rate of heartbeat. Locate the pulse in the wrist. Using a watch with a second hand, count the pulse for one-half of a minute before and after exercise and before rising in the morning. Note how soon after exercise the heartbeat becomes normal.

4. Observe circulation of blood in the frog. Saturate a piece of absorbent cotton with water containing some ether. Wrap the saturated cotton around a tadpole, or hold the cotton where a frog must breathe the ether fumes. When the animal has become quiet, place the tail of the tadpole or the web of the frog's foot under the low-power objective and then under the high-power objective of a compound microscope. Can you see the network of tiny blood vessels? Of the capillaries? Those vessels in which the blood moves in spurts are tiny arterioles; the larger vessels in which the blood moves slowly and steadily are veins.

Test

Directions: On a separate piece of paper make a list of letters from A to J, corresponding to the letters of the statements below. Place a check mark (√) after the letter if the term in italics is correctly used within the statement. If the term in italics is incorrectly used, place an X after the letter, and next to this write the number of the term which you think would be correct in the statement. Do not write in the book.

A. The cells in the blood that carry oxygen are called *red corpuscles*.
B. The red coloring matter in the blood is *fibrinogen*.
C. The microscopic thin-walled blood vessels that form the network connecting veins with arteries are *capillaries*.
D. A condition in which the amount of hemoglobin in the blood is inadequate is *hemophilia*.
E. Vessels that carry blood from the heart to all parts of the body are *veins*.
F. The pressure of blood within the arteries is known as the *pulse*.
G. The yellowish fluid left after the blood clots is *serum*.
H. The circuit of blood from the heart to the lungs and back to the heart is the *systemic* circulation.
I. The blood cells that protect the body against the invasion of bacteria are *white corpuscles*.
J. The regions of the heart that pump the blood to all parts of the body are *ventricles*.

1. plasma
2. coronary
3. blood pressure
4. hemoglobin
5. auricles
6. white corpuscles
7. arteries
8. anemia
9. platelets
10. arterioles
11. valve
12. lymph
13. pulmonary

Associated subjects

Biology: The heart and blood vessels as organs of circulation, and the blood as a medium of transportation. . . . The nature of blood, and the movement of blood in the capillaries. . . . The importance of circulation in all animals.

Chemistry: The composition of the air, and the nature of iron compounds.

Home economics: The choice of foods, with reference to the elements they contain.

Physical education: The importance of having the heart examined before undertaking strenuous exercise.

Physics: The action of valves in the operation of a force pump.

References

BAYLES and BURNETT. *Biology for Better Living.*
CARLSON and JOHNSON. *The Machinery of the Body.*
FENTON and KAMBLY. *Basic Biology for High Schools.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*

Films

The Heart and Circulation. 11 minutes, sound. Encyclopaedia Britannica.

Be Your Age. 11 minutes, sound. Metropolitan.

15. *WASTE MATERIALS ARE REMOVED FROM THE BODY*

CHEMICAL activity in the body is accompanied by the formation of waste products. In a body which is healthy and in good working order, the disposal of waste materials is almost automatic. Our especial task is not to interfere with the body in doing its work. We have organs which remove these wastes from the body, some of them designed solely for this purpose. In other organs, such service is only incidental. The organs which eliminate waste products are the skin, the lungs, the kidneys, and the large intestine.

Do you know . . .

1. How body waste is formed?
2. Why the regular elimination of waste materials is important?
3. If a good complexion is related to good elimination?
4. If it is harmful to check perspiration?
5. If a daily bath keeps the pores clean?
6. Why it is harmful to take commercial laxatives?
7. If it is necessary to have a bowel evacuation every day?
8. How much water we should drink a day?
9. How perspiration is produced?
10. What body waste is given off by the lungs?
11. Why all the blood must pass through the lungs?
12. Where carbon dioxide is formed in the body?
13. How carbon dioxide in the blood controls the rate of breathing?
14. What wastes are excreted by the kidneys?
15. What waste product is formed from the digestion of protein?
16. What an excess of albumin in the urine indicates?
17. How undigested food is eliminated?
18. What is the cause of amebic dysentery?
19. Why sugar diabetes is not a disease of the kidneys?
20. If all bacteria found in the intestine are harmful?
21. What is meant by peristalsis?
22. How peristalsis is stimulated?
23. How typhoid bacteria get into the intestine?

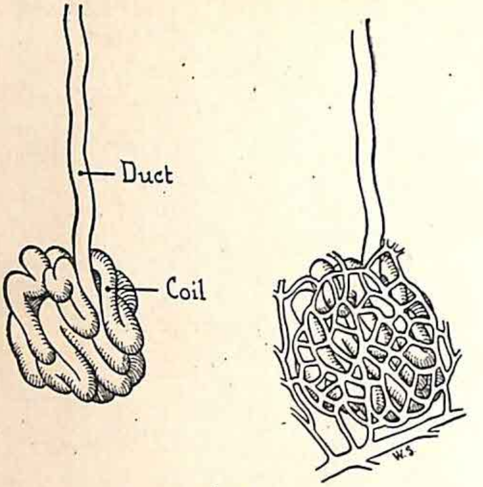
Courtesy J. I. Case Company

A FARMER works harder than a man who sits back of a desk all day, but he has a better chance of maintaining health. The outdoor worker has opportunity to breathe fresh air and, by perspiring freely, throw off wastes through the skin.

The skin (perspiration). Tiny tubes called sweat glands open on the surface of the skin. One of their functions is to remove waste products carried by the blood to the capillaries around the base of each tube. The material (perspiration or sweat) is largely water which contains dissolved salts and other substances. Perspiration is constantly forming on the surface of the skin. If the excretion of perspiration is slight, the solid wastes are left in the mouth of the gland as the water evaporates. If perspiration is abundant, as in hot weather or during active exercise, the accumulation of waste is washed out. Bathing, after perspiring heavily, cleanses the body of these wastes. An adult perspires from two to six pints of liquid daily, depending on his activity, on the water he has taken in with his food and drink, on the clothing he wears, and on the climate or weather. If only a small amount of liquid is excreted by the skin, the kidneys will give off a larger proportion than usual. Normally, the amounts are about equal.

The lungs (where respiration begins). The most abundant waste product of the lungs is carbonic acid or carbon dioxide. It is formed within the body wherever food is changed into body material or energy. It is thrown off as waste from the lungs during breathing.

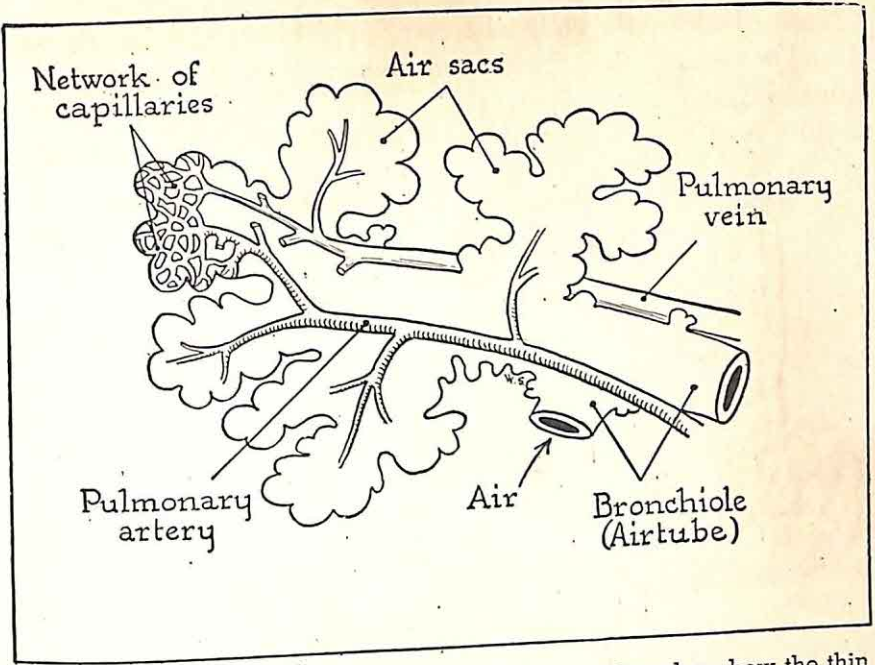
In Chapter 8 we learned that the lungs are made up of innumerable tiny air sacs. The walls of these sacs are very thin and contain many tiny blood vessels. Since the walls of the blood vessels are also extremely thin, there is the closest contact between blood and air found anywhere in the body. All the blood of the body passes through the lungs, where every red corpuscle is supplied with fresh oxygen, and the blood gets rid of its carbon dioxide waste. The lungs are merely groups of tiny cavities through whose delicate walls this exchange between oxygen and carbon dioxide takes place. Water also escapes into the air from the lungs.



Network of capillaries

A NETWORK of capillaries completely surrounds the base of a sweat gland to furnish the organ with its supply of blood.

Respiration in the tissues. Breathing has a double purpose. The first purpose is to take in air, which is about one-fifth oxygen; the second purpose is to throw off carbon dioxide which has been released from the blood. The blood picks up the oxygen and carries it throughout the body. Respiration as a cell activity takes place in the tissues. Here the oxygen combines with food (oxidation), and there is liberation of energy and the formation of water and carbon dioxide, as well as other waste products. These waste products must be disposed of. The carbonic acid gas is picked up wherever it is formed and carried by the blood to the lungs. There most of it is given off and a fresh supply of oxygen

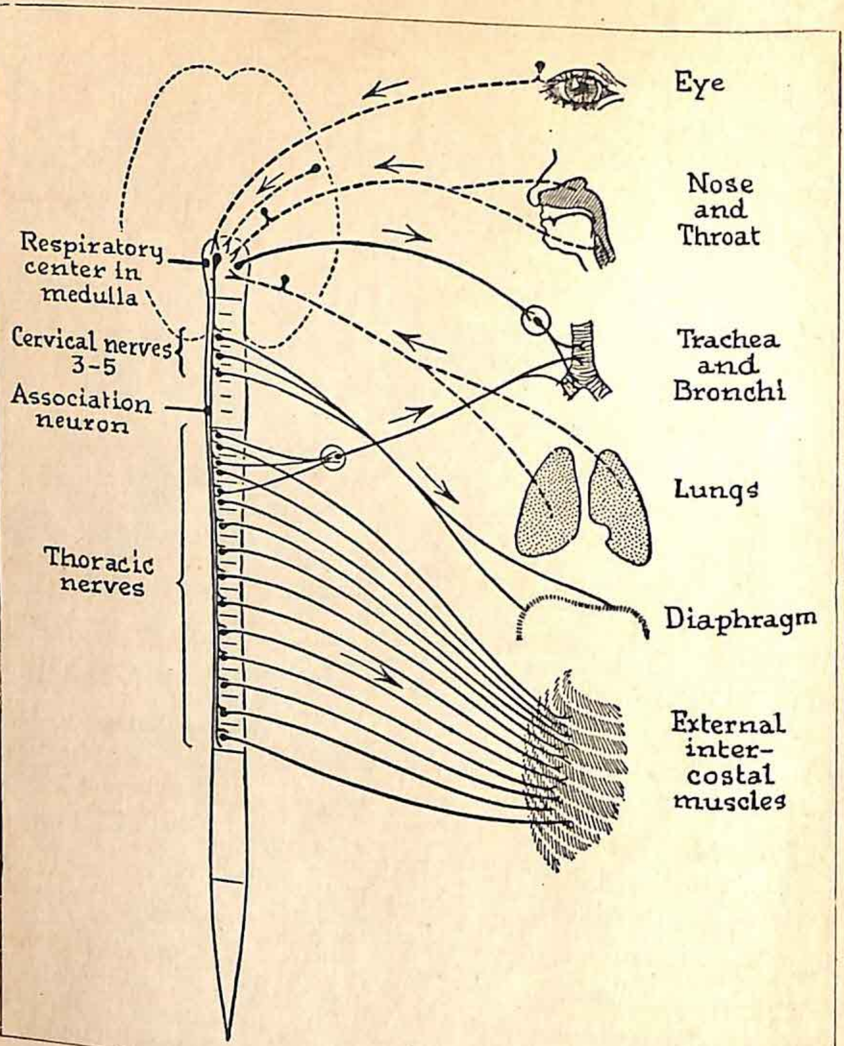


THE AIR SACS in this picture are greatly enlarged to show how the thin walls of the blood vessels (capillaries) touch the thin walls of the air sacs. Here the blood picks up oxygen and gives up carbon dioxide, moisture, and some organic wastes.

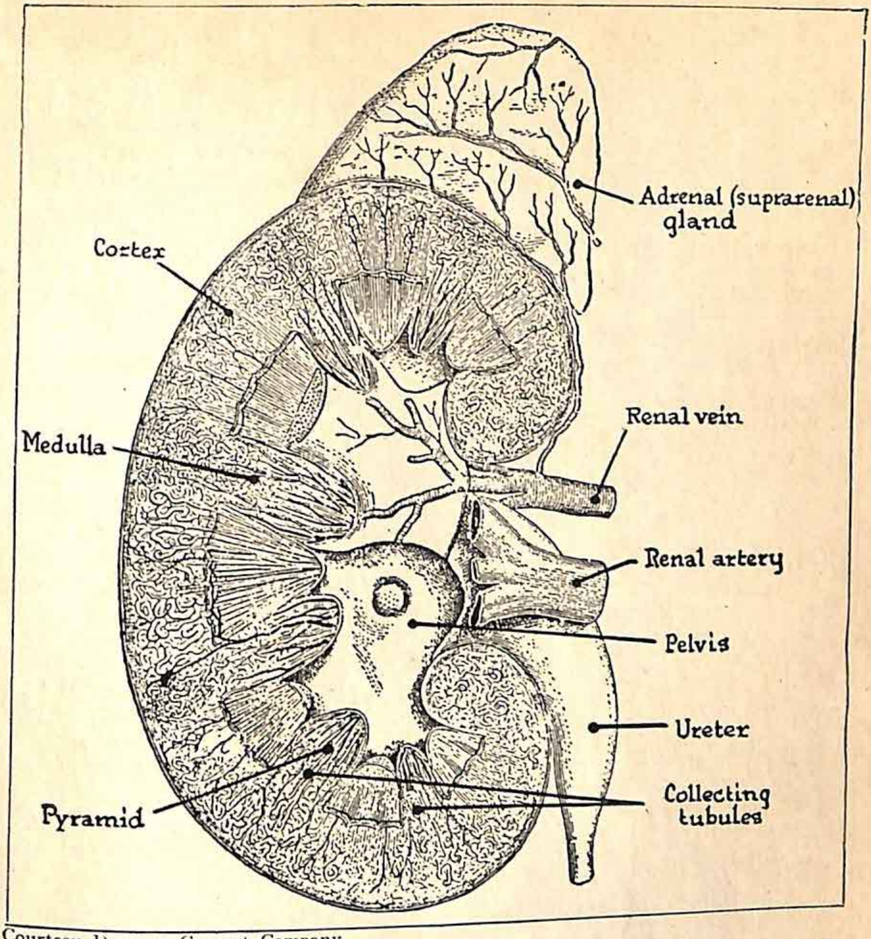
is taken up by the blood from the air introduced in breathing.

Control of respiration. The respiratory center in the brain which controls breathing is extraordinarily sensitive to variations in the carbon dioxide content of the blood. The slightest excess of carbon dioxide gas in the blood stimulates this center. We then breathe more rapidly and deeply, so as to throw off more carbon dioxide and take up more oxygen. This restores the blood to its normal condition. Any exertion increases the production of carbon dioxide. This accounts for the heavier breathing during and immediately after exercise.

The kidneys (urination). The sole function of the kidneys is to eliminate fluid waste from the body. This waste consists of broken-down products of protein, with inorganic salts and foreign materials, and a high percentage of water, partly necessary to carry the solids in solution, and partly representing a constant ad-



ANY NERVE carrying impulses to the respiratory center in the medulla (spinal bulb), from the higher centers of the brain or from any organ—such as the eye or nose—may influence the activity of the respiratory center. Nerve cells establish connections between the respiratory center and the spinal cord. Nerve fibers from these cells go to the respiratory passages (windpipe, bronchi) and the muscles of respiration (diaphragm, rib muscles). Hence, the breathing movement may be altered by a variety of stimuli or conditions.

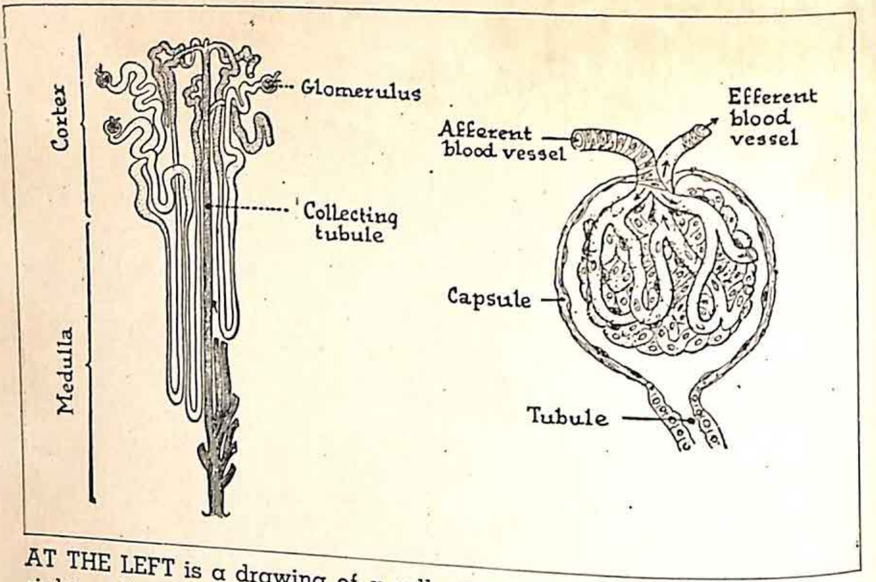


Courtesy Denoyer Geppert Company

A LENGTHWISE SECTION of the kidney gives a clear indication of the position and arrangement of all of its parts.

justment of the amount of fluid required by the system. The kidneys are two organs which lie in the upper part of the abdomen, one on either side of the backbone. They are made up of an immense number of tiny coiled tubes which originate in curious little knots of tinier tubes each of which is called a *glomerulus.* These peculiar structures take from the blood a large amount of water, urea, and other salts. This combination of substances forms what is known as urine.

Urea is the chief end product of protein digestion. It is carried

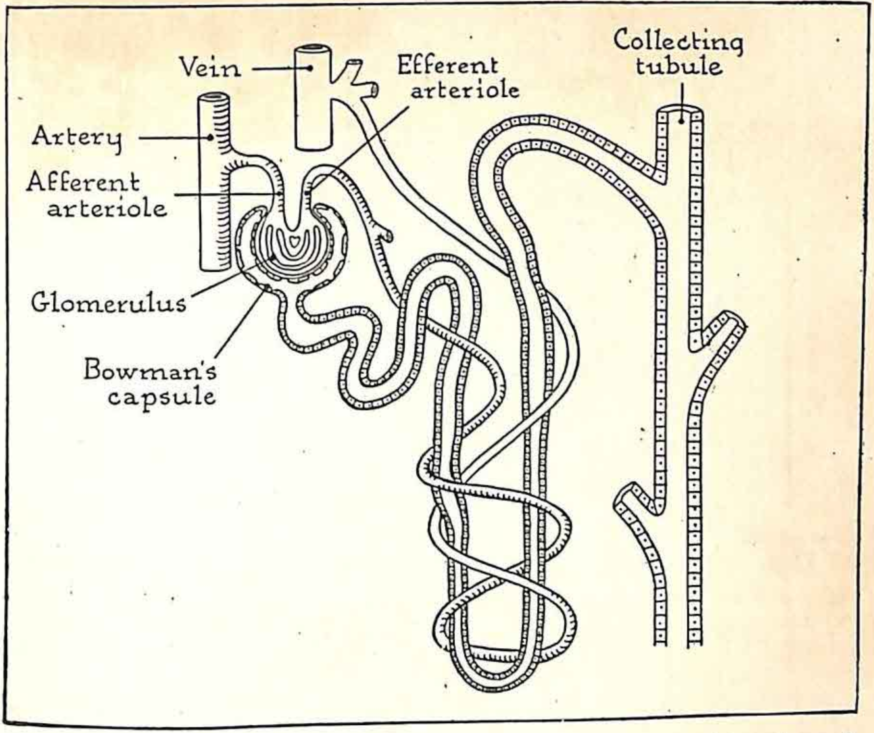


AT THE LEFT is a drawing of a collecting tubule with glomeruli; at the right, a diagram of a glomerulus and capsule. The blood vessel carrying blood to the glomerulus spreads out in a tuft of capillaries. The surrounding capsule and the beginning of the tubule are shown.

in the blood from the liver, where it was formed, to the kidneys. The yellow color of urine is derived from the bile which has been absorbed into the blood from the intestine. Some of the constituents of urine do not dissolve readily. So we should drink plenty of water daily to provide a solvent for these materials.

Urine passes from the kidneys, through two tubes called *ureters*, to the bladder, where it is stored until voided. The bladder will hold a good deal of liquid, but it should be emptied when it gives the sensation of fullness. Rest at night should not normally be disturbed by urination. Frequent urination may indicate irritation by urine that is too concentrated. This may result from not drinking enough water. Frequent urination may also be due to certain *diuretics*, such as caffeine in tea and coffee.

Diseases of the kidneys. Normal urine should contain no albumin. The presence of albumin in the urine may indicate a dangerous kidney condition known as Bright's disease. Sugar in the urine is associated with diabetes, which is not a disease of the kidneys but of the pancreas (see p. 299). Hard accumulations, com-

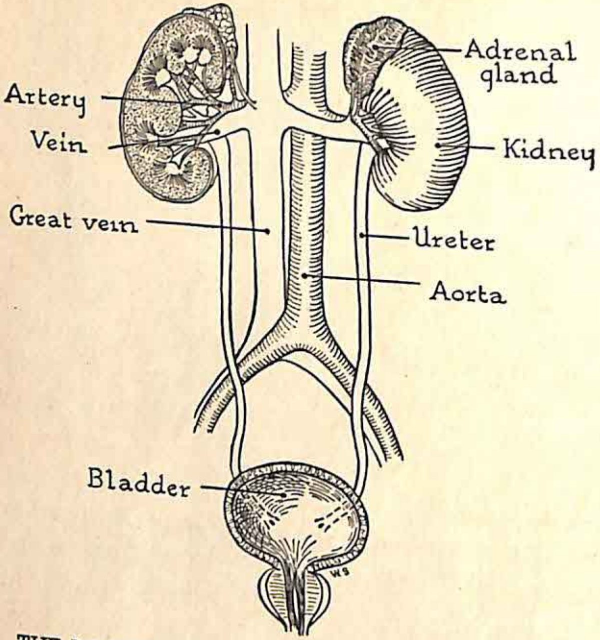


THE CAPSULE, no larger than a speck of dust, is shown in this enlarged diagram as a double walled cup within which is suspended a coiled blood vessel (glomerulus). Here the urine is filtered from the blood and passes into the collecting tubule.

monly known as stones, sometimes form in the kidneys and may lodge in a ureter or pass into the bladder. Their presence in any of these parts may cause extreme pain, sometimes sudden in onset.

Any kidney complication should be considered as serious, but a pain in the back does not usually indicate kidney trouble. Doctoring for kidney disturbances without consulting a physician may be not only useless but harmful. Self-medication usually postpones the time when correct diagnosis and treatment are possible.

The large intestine (defecation). After food has been digested in the small intestine, the undigested part passes on to the large intestine to be stored until it can be eliminated. During the time the food remains there, absorption of water from the food mass continues. Gradually the waste material or *feces* is moved along and accumulates in the lower part of the large intestine, called the rectum. As the waste material accumulates, the walls of the rectum become distended. This creates the impulse to empty the bowels. If this impulse is neglected, the stimulus loses its effectiveness, more water is absorbed while the food lodges there, the material becomes more compact, and defecation is more difficult.



THE POSITION of the kidneys, the ureter, and the urinary bladder, and the main blood vessels connected with these organs, is shown here. The adrenal glands are located on top of the kidneys.

Food taken into the stomach stimulates the movement of feces from the lower colon into the rectum. Therefore the period just after breakfast is a desirable "habit time." In some persons the waste matter may accumulate for one or two days before the bulk is sufficient to stimulate active peristalsis. This may be a normal condition for that individual, and if every-other-day movement of the bowel is regular, there is no need for alarm.

Intestinal bacteria. The alkaline condition of the food mass in the intestine is very favorable for the growth of bacteria. From the food material in the digestive tract these microbes produce various substances—most of which are harmless, while others are harmful. Under normal conditions, these substances are produced in such small amounts as to need no consideration. If, however, evacuation is neglected, these poisons may accumulate to the point of harming the body. It is apparently very important to maintain a regular schedule for the elimination of these wastes from the body.

The presence of bacteria, especially in the lower small intestine and the large intestine, is a normal condition. If they remain in the intestinal tract, the bacteria are usually harmless. Their significance in both health and disease has not been clearly demonstrated.

In addition to these bacteria found normally in the intestine, foreign microbes at times find entrance in contaminated food or drink. Such diseases as typhoid fever and cholera are caused by bacteria. Amebic dysentery is caused by a microscopic animal (protozoan), an ameba. Any foreign material may cause irritation which so stimulates the activity of the intestinal tract that griping pains occur. The offending material is hurried on, together with the other contents, and is eliminated in a fluid state. This condition is called *diarrhea*. Like vomiting, diarrhea is a natural protection of the body against poisoning.

Preventing constipation. If all the digestive processes are working in harmony, evacuation of the bowels is a regular and natural procedure. The frequency will vary with individuals, for it is largely a matter of habit. In cases where elimination is irregular or difficult, a lasting remedy should be sought by locating the cause rather than by using drugs and pills. A diet containing more roughage stimulates peristalsis (see p. 190). Vitamin B_1 is at present thought to be an important aid.

Many laxatives—good, bad, and indifferent—are on the market. Dependence on their regular use is decidedly inadvisable. The enema (a watery injection in the lower bowel, usually containing soapsuds) should be used only as an emergency measure.

Constipation sometimes develops through loss of tone of the muscles of the abdomen. Exercise will help to correct this condition.

In conclusion

MOST persons are very careful to see that they have food regularly. Just as important as this regular feeding of the body is the regular discharge of wastes from the body. Good habits are as necessary in one case as in the other. These habits are exercise, to aid in carrying fresh blood to the lungs and intestines and to keep the muscles in good tone; good posture, to allow room for all the organs to work freely; regularity of evacuation of bladder and bowel; drinking plenty of water, to dilute the urine; control of the diet, so that it will provide materials which are digestible and nourishing and will aid the body in its normal functioning. To practice these habits is the responsibility of each individual.

Activities

1. Examine the skin with a hand lens on a warm day to observe sweat coming out of the pores. The secretion of sweat may be stimulated by holding a finger in very warm water for a minute. After removing the finger, dry it and quickly examine it with a lens. Note the arrangement of the sweat pores.

2. Show what the body gives off during respiration:
   a. Blow through a glass tube into a test tube containing limewater. Explain what happens. (Carbon dioxide is the only substance that makes limewater milky.)
   b. Breathe on the bulb of a thermometer and record the changes.
   c. Breathe gently on any cold glass or polished metal surface. What are the products of respiration?

3. Weigh yourself before and after a period of hard work in the gymnasium. Is there any loss in weight? How must the change of weight have been brought about? When oxidation of food or tissue takes place in the body, at least three products besides heat are formed: organic wastes, carbon dioxide, and water.

4. Observe the structure of the kidney. Some idea of the internal structure of the kidney of man may be gained by examining the kidney of a sheep or pig. Get the butcher to leave the mass of fat around the kidney. What is the use of the fat? After removing the fat, note that

the kidney appears to be closely wrapped in a thin coat of connective tissue. Remove the kidney from this covering. The concave depression is called the *hilum*. The central hollow tube passing from this region is the ureter. Blood vessels also enter and leave the kidney at the hilum.

Cut the kidney lengthwise into halves, cutting through the hilum and the ureter. Locate a) the outer (cortical) region, b) the inner, more reddish (medullary) layer, and c) the cavity (pelvis) of the kidney. The tubules, in which the real work of excretion is performed, are located in the medullary layer and empty by tiny pores or openings into the pelvis.

Test

Directions: On a separate sheet of paper write the letters from A to J, corresponding to the letters of the practices given below. Place a check mark (√) to the left of the letters indicating the practices which you consider good. To the right of the checked letters place the numbers for the reasons given below to support the practices which you consider good. Do not write in the book.

Paul has been having frequent headaches lately. At times he experiences spells of drowsiness and a general tired feeling. His appetite is not as good as usual, his tongue is coated, and his breath has a bad odor. He also has noted that his elimination of bowel wastes has become somewhat irregular. He wants to correct this condition. What should Paul do for his headaches?

A. Consider his posture to see if he is standing and sitting correctly and so increase circulation in the abdominal organs.
B. Eat a dish of bran at least once a day.
C. Eat regularly but include more vegetable foods in his diet.
D. Drink eight or ten glasses of water daily.
E. Take vigorous, systematic exercises that involve the abdominal muscles.
F. Plan regular time for elimination of wastes (preferably after breakfast) and make this a part of his daily routine.
G. Take a saline cathartic or some widely advertised laxative medicine every three days to stimulate peristalsis.
H. Include foods in his diet that are rich in vitamins.
I. Consult a physician if constipation persists.
J. Take a tablespoonful of mineral oil each night.

1. Water is absorbed from the material in the colon, and unless sufficient moisture is present, the wastes become dry and hard and are moved with difficulty.
2. Exercise that involves the muscles of the abdominal walls will aid in maintaining the tone which is necessary for good intestinal elimination.
3. Saline cathartics stimulate peristalsis and draw water into the intestine. This softens the wastes.
4. Food rich in cellulose tends to prevent constipation.
5. Undigested food residues tend to stimulate an inactive colon into action.
6. Vitamins in the diet favor the development of good muscular tone in the intestinal wall and increase one's appetite.
7. Mineral oil is not absorbed by the intestines and forms with the water and food an emulsion which lubricates the walls of the intestine.
8. If the nervous stimuli created by the presence of feces in the colon are ignored, a blunting of the sensitiveness of these stimuli may result.
9. Poor posture tends to compress the organs of the abdominal cavity, interfering with the circulation and nerve action. This results in poor muscular tone.
10. Proper functioning of the bowel depends on several interacting factors which must work together to eliminate wastes.
11. Mental influences, such as haste, fear, and anxiety, may inhibit stimuli that activate the normal reflex which causes the colon to contract and expel its contents.

Associated subjects

Biology: The fact that waste products result from chemical changes within the body and must be eliminated. . . . How the skin, the lungs, the kidneys, and the large intestines are fitted for this work. . . . How to keep these organs in good working condition.

Chemistry: Tests showing the properties of carbon dioxide and oxygen.

Home economics: Diets necessary to maintain proper elimination and to correct faulty elimination.

Physical education: The need for adequate bathing to remove body wastes that are thrown off through the skin during exercise. . . . Exercises for correcting poor elimination.

Physics: How a dissolved salt is deposited after the evaporation of its solvent. . . . Demonstration of osmosis.

References

BAYLES and BURNETT. *Biology for Better Living.*
BROWNELL and WILLIAMS. *The Human Body.*
CARLSON and JOHNSON. *The Machinery of the Body.*
GOLDBERGER and HALLOCK. *Health and Physical Fitness.*
MEREDITH. *Health and Fitness.*

Films

Kidneys, Ureters, Bladder. 11 minutes, sound. Bray Studios.
The Work of the Kidneys. 11 minutes, sound. Encyclopaedia Britannica.

16. SUNLIGHT AND FRESH AIR ARE HEALTH ESSENTIALS

EVERYONE knows that fresh air and sunlight are important to health. Yet opinions differ as to what fresh air is, why it is important, and to what extent sunlight is beneficial.

From the earliest days sunlight has been associated with health. And since the beginning of the present century, much evidence has been accumulated as to the health-giving influence of sunlight in the treatment of certain diseases.

Do you know . . .

1. What determines good air?
2. If carbon dioxide is a poison?
3. What relative humidity is?
4. What is a desirable temperature range for the home?
5. Why dry outdoor air gives a sense of vigor?
6. Why sunlight is beneficial?
7. What a sun bath is?
8. What ultraviolet rays are?
9. What sun lamps are?
10. How sunlight is modified by passing through window glass?
11. What harm may result if the body is exposed too long to the rays of the sun?
12. What the chief gases are that make up the atmosphere?
13. Why the air in a crowded room causes discomfort?
14. What temperature and relative humidity give the greatest comfort in heated rooms?
15. Why moist warm air is oppressive?
16. Why exposure to cold air may be harmful?
17. What a humidifier is?
18. How the spectrum is formed?
19. What rays of light have the greatest chemical activity?
20. What benefit is derived by the body from the ultraviolet light?
21. Why vitamin D is sometimes called the "sunshine vitamin"?
22. How rickets may be prevented?
23. What the purpose of ventilation is?
24. What air conditioning is?

Courtesy Maine Development Commission

MOUNTAIN STREAMS are popular fishing spots, attracting amateur and skilled anglers alike during every vacation season. As one fishes with a rod and reel from the rocky bed of a stream, one enjoys the benefits of relaxation in the fresh air and sunshine.

Fresh air. The old idea that the quality of ordinary air is determined by its chemical content has been found to be wrong. No longer is it believed that air is bad because it contains much carbon dioxide. Experiments have failed to prove that breathed air contains any actively injurious substances. On the other hand, it has been found that the physical properties of air are more important than the chemical properties as far as human comfort is concerned. These are temperature, relative humidity or moisture content, and the movement of the air.

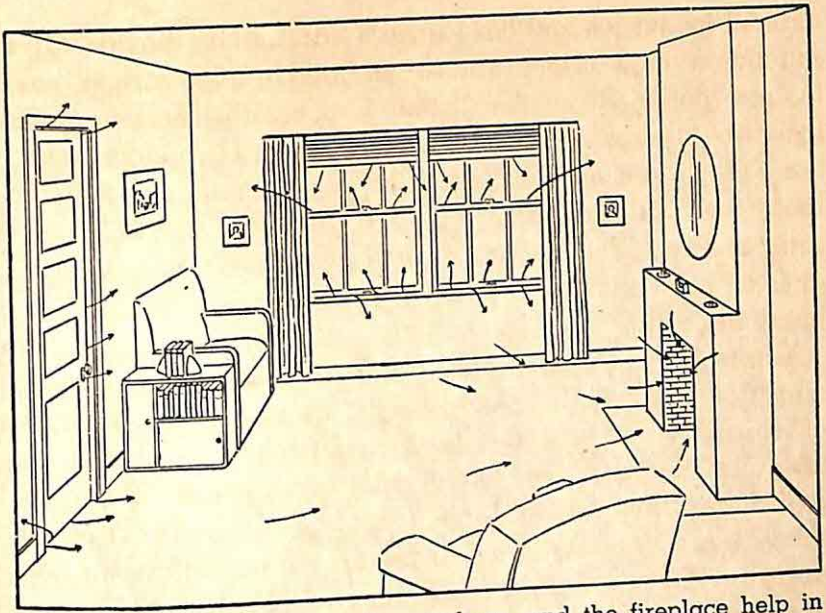
Air in a crowded room. Outdoor air consists of a mixture of gases, of which approximately 78 percent is nitrogen, 21 percent oxygen, and .03 percent carbon dioxide. "Breathed air" has lost some of its oxygen and has gained a little carbon dioxide. It still contains enough oxygen, and the addition of more carbon dioxide has not "poisoned" it. Air that has been breathed becomes stale or bad by becoming too warm and too moist, and the odors that have been added to it only make it unpleasant. Persons in a crowded room may not notice that the air is growing bad until they become restless, develop a headache, or feel faint. These effects are due, not to a reduction of oxygen or an increase of carbon dioxide, but to improper temperature and humidity, and unpleasant odors.

Temperature and moisture. An experiment was performed in which persons were placed in glass chambers, the air conditions of which could be regulated and recorded. These persons became uncomfortable when the temperature was about 85 degrees Fahrenheit and the humidity high. When the air was examined, it showed some increase in carbon dioxide and a slight reduction of oxygen. But this was not responsible for the discomfort, for the breathing of fresh air from a tube leading to the outside gave no relief. People on the outside experienced no discomfort from breathing through a tube the air of the chamber. When the temperature in the chamber was lowered and the moisture was decreased and the air was set in motion, relief was felt, although no change was made in the oxygen and carbon dioxide content of the chamber.

In heated rooms the greatest comfort is experienced with the temperature at 68 degrees Fahrenheit and the relative humidity between 40 and 50 percent.

Relative humidity is the percentage relation of the moisture in the air to the maximum amount it could hold at that temperature. When the relative humidity is high, little moisture can be evaporated from the body. If the relative humidity is low, the body may lose too much heat by evaporation.

Heat is constantly being produced by the body, and unless this heat can escape, the body temperature will rise and discomfort will follow. The heat is conducted or carried away from the body by the surrounding air and by evaporation. Cold air with a high moisture content seems colder than dry air of the same temperature, because moist air conducts heat away from the body faster.



CRACKS around the door, the windows, and the fireplace help in ventilation.

On the other hand, moist hot air is more oppressive than dry hot air of the same temperature, because moist air retards the evaporation which cools the body. Because of the dryness of the air, the rather sharp temperature variations of the Rocky Mountain Region, for example, are not felt so severely as the same variations would be felt in regions of greater humidity. Rapid evaporation of body moisture, due to dry outdoor air, has an exhilarating effect on the body.

Air movement. Another factor in the conditioning of air for comfort is movement. The body is surrounded by an "aerial blanket" that is either warm or cold, moist or dry. Air in motion tends to break up or change this blanket, thus making it easier for the body to lose heat. A breeze with the temperature at 95° F. may feel more comfortable than still air at 80° F. As much of the active part of each day as possible should be spent out-of-doors, where the air is moving and has more favorable humidity. Indoor air, however satisfactory it can be made, is not a perfect substitute for outdoor air. Fresh air, when cool and dry enough, has a remarkable bracing effect on the whole system.

Ventilation. To make indoor air comfortable and livable, it is best to let in outside air by proper ventilation, warming it when necessary. Air seeps in and out around doors, windows, and fireplaces, and through the walls, so that there is considerable natural ventilation or changing of air at all times, even if doors or windows are not open.

The "fresh air fad" seems to be on the wane. No longer is it believed necessary to swim in fresh air day and night to keep healthy. The old method of treating tuberculosis patients in extremely cold air has been practically abandoned. In the treatment of common colds and other respiratory disorders, cold air is a detriment. Treatment is more effective when the patient is permitted to breathe air that is properly conditioned. Clean, balmy air, moving rapidly enough to keep the body comfortable, seems most desirable. Healthful air is also free from poisonous gases, irritating dust, and other impurities.

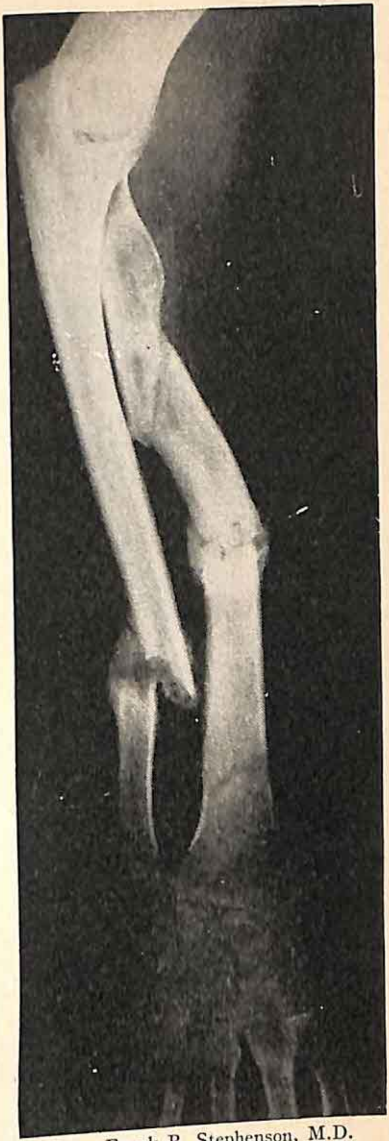
Conditioning the air. The air inside of most buildings, especially in winter, is far from ideal. It is often drier than is desirable. Most so-called "humidifiers" do not put enough moisture in the air to make them worth while. Natural humidifiers include plants in a room, and steam from cooking and from the laundry. The conditioning of air is an attempt to provide those conditions of purity, temperature, motion, and humidity in which individuals are most comfortable. The air is first filtered and washed so that smoke, dust, gases, and even pollens are removed. Some of the types of air-conditioning apparatuses on the market are effective; others are worthless. In the best systems, the air can be filtered, warmed, and moistened in winter and filtered and cooled in summer. For the average home, efficient air conditioning is still too expensive.

Sunlight. Light is the impression produced on the eye by vibrations of certain waves. Color is a group of sensations which depend upon the special lengths and frequencies of light waves falling on the retina.

If a beam of sunlight is allowed to pass through a triangular glass prism and to fall upon a white screen, this beam of light is broken up into seven colors—red, orange, yellow, green, blue, indigo, and violet. This result of the breaking up of white light is called the *spectrum*. Red is least bent out of its course and violet most. The light waves are longest at the red end and shortest at the violet end of the spectrum.

Immediately beyond the red of the spectrum are rays of still greater wave length, known as *infrared rays*. These manifest themselves in the form of heat. Beyond the violet rays are rays of shorter wave length called *ultraviolet rays*. These have greater chemical activity than any visible light rays. They act upon photographic plates, produce sunburn and freckles, and kill bacteria.

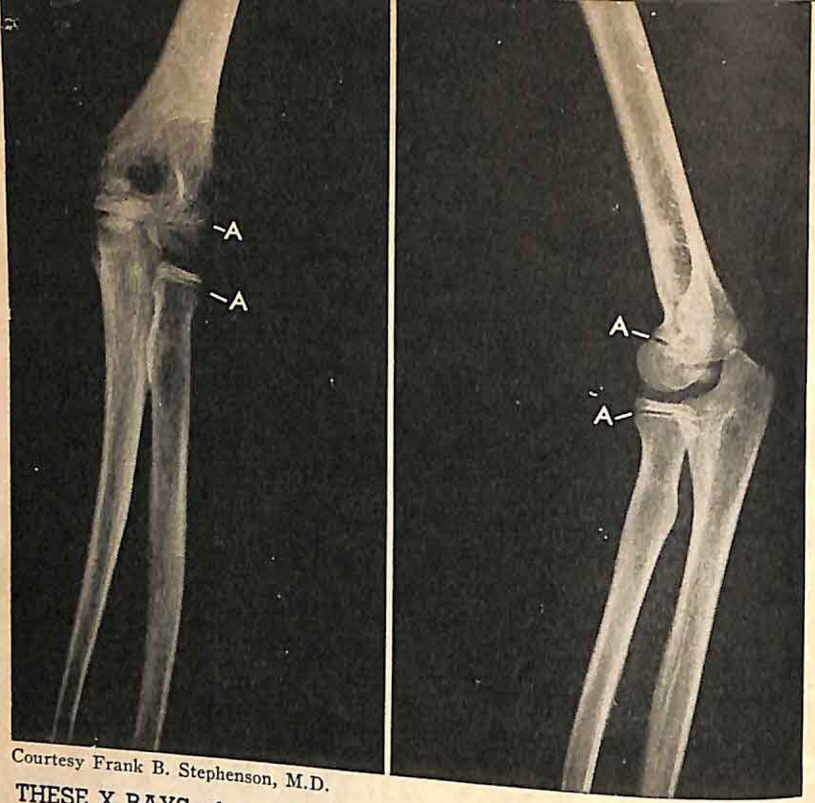
Shorter than the wave lengths of ultraviolet rays are the wave lengths of X rays produced by a special electrical apparatus. They are far more penetrating than even the ultraviolet. Their ability to pass through opaque substances has made them extremely useful in the treatment of cancer and other diseases and in the making of X-ray pictures.



Courtesy Frank B. Stephenson, M.D.

THIS X RAY of the right forearm and wrist shows fractures in the radius and ulna.

Value of sunlight. We now know that sunlight has certain positive values to the body. Experiments have proved clearly that the ultraviolet rays of sunlight will cure a disease of the bones called *rickets*. This idea, as is often the case with useful discoveries, has been taken up by faddists and sometimes exploited t



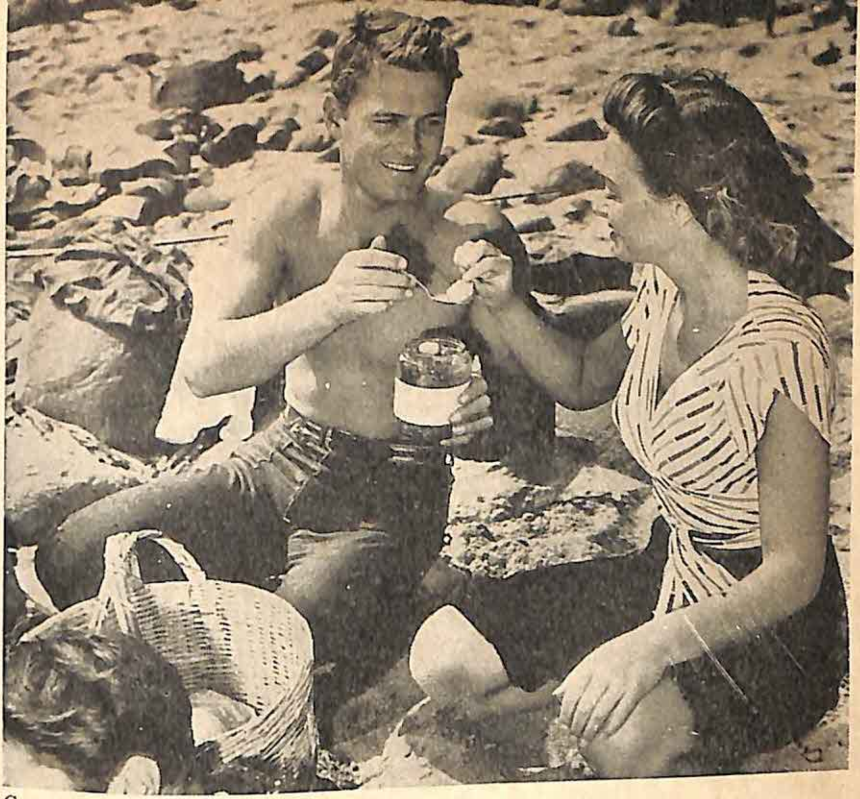
Courtesy Frank B. Stephenson, M.D.

THESE X RAYS of an elbow of a ten-year-old child, front and side views, indicate the pads of cartilage (*dark lines opposite A, A*) in which lengthening of the bones takes place. If the bones develop normally, the cartilage will later become bone, the ends (epiphyses) will unite with the main bone, and growth in length will cease.

the detriment of those concerned. To get artificial sunlight, people have been induced to buy expensive sun-ray lamps, some of which are useless and others of which should be used only on the advice of the physician. The rays from these lamps are often several times more powerful than the sun's rays. When using them, masks or eyeglasses should be worn to protect the eyes.

The sun itself, under proper conditions, is the best sun-ray lamp one can use. Sunshine, or any sun-ray lamp, should be used with proper precautions. Serious complications have arisen from undue exposure to the sun's rays, as well as incautious use of sun-ray lamps.

Sunlight improves the functioning of the skin by stimulating



Courtesy Look Magazine

SUNLIGHT improves the functioning of the skin, but excessive exposure may cause serious burning of the skin. The most beneficial effects from sunlight are obtained by exposing the skin gradually and for short intervals.

the circulation of blood in the skin and by increasing perspiration. The ultraviolet rays of the sun help to heal wounds and to build up bodily resistance to infection. They help to repair worn-out tissue and to build up underdeveloped muscles. Sunlight destroys bacteria and helps in the cure of rickets. It increases the power of the blood to resist disease and serves as a mental and emotional stimulant.

Ultraviolet rays. Ultraviolet rays, acting on any part of the skin, affect the whole body. Tissues not exposed to the sun are benefited by the action of these rays on other parts of the body. The effect upon health of ultraviolet rays is largely due to their influence upon the use of calcium and phosphorus. The ultraviolet rays act upon certain fatlike substances (ergosterol and, to a lesser extent, cholesterol) in the skin and transform them into

Courtesy H. Armstrong Roberts

THESE BOYS are getting ready to enjoy their own cooking. Exercise in the fresh air and sunshine always makes one hungry.

vitamin D. Like vitamin D, ultraviolet rays will prevent rickets.

The number of ultraviolet rays that reach the earth varies greatly with altitude and season. In many cities these healthful rays are filtered out by the dust and smoke in the air. They are more intense in spring and summer sunshine than in that of winter, and stronger at midday than in early morning and late afternoon. They are much more effective in the higher altitudes where the air is rare, dry, and clean. The sun's rays become intensified by reflection from water and snow, and in such conditions the danger of serious burns on the body from prolonged exposure is increased.

In high altitudes the beneficial effect of the sunshine is great throughout the entire year, because there the winter sunshine contains a higher proportion of biologically effective ultraviolet light than is present at lower altitudes.

Certain foods, such as cod-liver oil, contain vitamin D and help to cure rickets. During the winter, and in cities where these rays are not so plentiful, such foods with their stored-up sunshine are a means of building body health.

The infrared rays are transferred into heat and are beneficial to the body. The incautious use of infrared lamps may produce serious burns on infants or on patients too ill to protect themselves.

Sun bathing. If the exposure to the sun is carefully governed, so that too much is not received before the body is accustomed to it, good can result. Sun bathing exposes the skin to the effects of both the sun's rays and the air. The exposure of the body to the air also causes the skin to be stimulated or toned up. Sun bathing is less effective when taken behind ordinary window glass, for the ultraviolet rays are greatly reduced by passage of the sunlight through such glass. Only 20 percent of the ultraviolet rays pass through ordinary clean window glass, whereas 80 percent pass through clean quartz glass.

In conclusion

MAN is surrounded by an immense sea of air—the atmosphere. His comfort depends largely upon the effect of the air on his skin. Indoor air can be so modified by ventilation that it has the atmospheric conditions of temperature, movement, and relative humidity which remove heat from the body adequately but without the disturbing effects of strong drafts. Ventilation should also provide an exchange of air sufficient to prevent the accumulation of disagreeable odors. Sunlight is beneficial as a general physical and mental stimulant. It maintains many bodily functions, especially those related to circulation, at a normal pitch of health and activity. In reasonable doses it has a directly stimulating effect upon the skin, and to this effect is due much of the benefit produced by sunlight upon the whole system.

Activities

1. Keep a record for a week of the temperature in the different rooms in your home.
2. Make a survey of your room at home to locate the natural and artificial humidifiers.

3. Make a survey of the air conditioning and ventilation of your home, from the standpoint of heating, gases and objectionable odors, circulation of air, dust or smoke, open or closed windows, and draft deflectors.

4. Make an air deflector for your bedroom window from wood, tin, or glass.

5. Analyze the ventilating system in your school.

6. Measure the moisture in your classroom. Secure a wet-and-dry-bulb thermometer (hygrometer) and a relative humidity table from the physics department. Suspend the thermometers in the classroom for fifteen minutes; then read the two thermometers. Note the difference in the readings and consult the table. Have someone in the physics department help you interpret the table.

7. Write a report on the work of Dr. Rollier of Switzerland.

8. Visit the physical therapy department of some hospital where massage, hot and cold water, and electrical light-forming devices are used for the treatment of injuries and disease.

Test

Directions: On a separate sheet of paper write the numbers from 1 to 11. After each number write the word that best fits in the corresponding blank below. Do not write in the book.

Air that is breathed out has lost some of its (1)______ and gained a small amount of (2)______.

The three factors which make indoor air uncomfortable are temperature, (3)______, and (4)______. The best temperature for indoors is (5)______ degrees Fahrenheit.

The rays of the solar spectrum which penetrate the epidermis are (6)______ rays. These rays do not pass readily through (7)______ glass. They are (8)______ intense at high altitudes and (9)______ intense in the winter. A substance in the skin called (10)______ is activated by these rays to bring about the same change in the body as vitamin D produces. Sunlight is therefore a cure for (11)______, a disease of the bones.

Associated subjects

Biology: How oxygen is essential to life of both plants and animals. . . . Sunlight and air in relation to health.

Home economics: The importance of air and sunlight in the health of children and in the care of clothing and bedding.

Physical education: The prevention of sunburn in hiking and outdoor games and sports. . . . The treatment for sunburn.

Physics: The principles and methods of heating and ventilating buildings. . . . How relative humidity varies according to temperature. . . . Proof that light rays are due to differences in wave length. . . . Demonstration of the spectrum and effect of X ray. . . . Use of the thermometer. . . . Factors that govern temperature variation.

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WILLIAMS. *Healthful Living.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Films

Light Waves and Their Uses. 11 minutes, sound. Encyclopaedia Britannica.

The Human Skin. 11 minutes, sound. Bray Studios.

17. *YOUR BODY NEEDS REGULAR EXERCISE*

WEARING shabby, worn clothing or riding in a rattling, dilapidated car may wound your pride, but do you resent having a flabby, low-powered, run-down body machine? You have not all inherited equally strong bodies, but do you make the best of the bodies you have? You can make this body of yours much more efficient by recognizing the importance of six factors—fresh air, water, food, sleep, cleanliness, and exercise.

Modern life tends to make human beings "soft." Passive forms of recreation, such as listening to the radio, attending the moving pictures, or indulging in too much reading, dominate the lives of many young persons. Exercise, which is fundamental in maintaining health, is too frequently neglected.

Do you know . . .

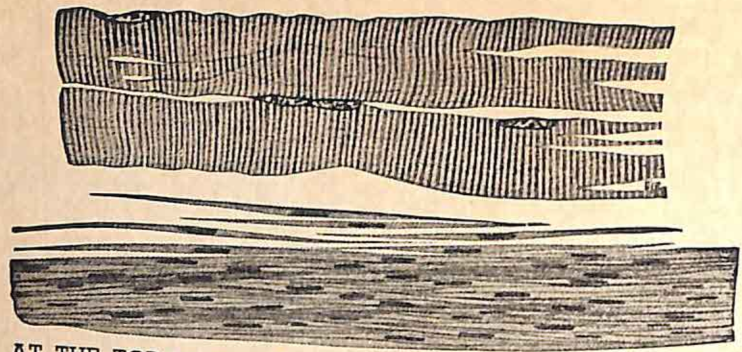
1. What muscle tone is?
2. How exercise is beneficial to the body?
3. What factors should determine the choice of exercise?
4. Why slow walking is an insufficient form of exercise?
5. How exercise strengthens the involuntary muscles?
6. What happens to muscles that are not used?
7. Why girls should not compete with boys in athletic contests?
8. Why training rules, although good for getting into condition for competitive games, are not also good for everybody?
9. Why it is better to learn to play a number of games than to specialize in one game?
10. That social dancing may be a good form of exercise?
11. How muscular energy is produced?
12. What kind of muscles move the parts of the skeleton?
13. How muscles are controlled by the nerves?
14. Why a competitive game may sometimes result in injury to the body?
15. Why a physical examination should be required before a person is permitted to take part in strenuous exercise?

Courtesy Bradford Junior College, Bradford, Mass.

ARCHERY is growing in popularity as an outdoor sport. Good eyesight and muscle tone make for success in this sport.

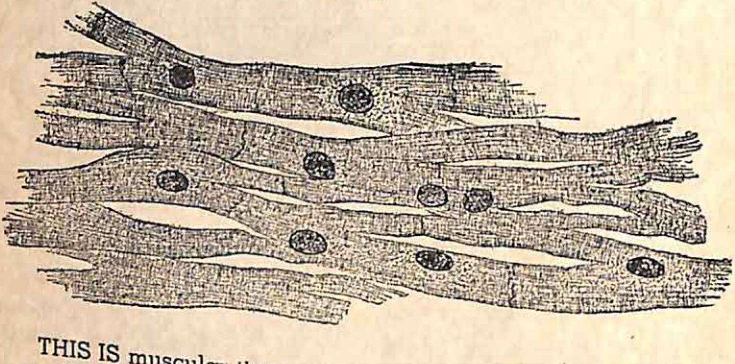
Muscle tone. There are two main groups of muscles. The muscles that are attached to the skeleton and move its parts consist of long striated (striped) cells. They are under the control of the will, and are called voluntary muscles. The muscles in the internal organs—the stomach and intestine and the walls of the blood vessels—consist of smaller spindle-shaped cells which have no striations or stripes. They are called involuntary because they are not under the control of the will. The heart muscle, which is also involuntary, consists of a special type of striated cells.

The movements of the body depend upon the strength and tone of all muscles. Tone is a quality of muscles that makes them



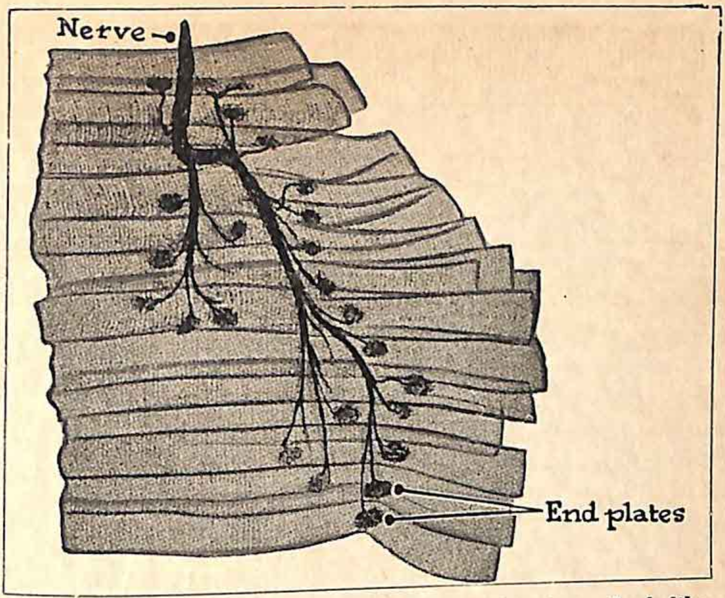
AT THE TOP is striated (skeletal, voluntary) muscular tissue, showing cross striations, magnified 275 times. At the bottom is nonstriated (involuntary, smooth) muscular tissue from the intestine, magnified 200 times. Several isolated fiber-cells are seen near the middle of the picture.

ready for action at all times. Lack of tone is described as flabbiness. When the muscles in the arms and legs are flabby, it is likely that the muscles in the heart and other organs are flabby also. In a large degree, that which improves the tone of one set of muscles improves the tone of all.

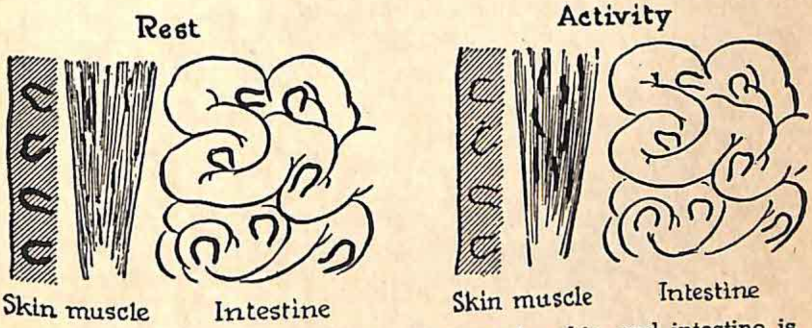


THIS IS muscular tissue of the heart, magnified 375 times.

The neuromuscular system. With the possible exception of the heart, muscles cannot react without receiving nerve impulses from the brain or spinal cord. All movements in the body depend upon teamwork between the muscles and the nerves that control them. Everything which improves a muscle must affect the nerves controlling the cells of that muscle. Nerves and mus-



THE NERVE END plates in striated muscular tissue look like this when magnified 135 times. A bundle of nerve fibers separates to supply the individual muscle fibers.



DURING REST (*left*) the blood supply to the skin and intestine is abundant, while the blood supply to the muscles is limited, as shown by the few capillaries which are open. During muscular activity (*right*) less blood flows to the skin and intestine, but the supply to the striated muscles is abundant; more vessels are open, and all in the muscle are dilated. The carbon dioxide which is produced during activity has two effects on circulation: first, a local dilation of the vessels in the muscles; second, a constriction of vessels in the skin and internal organs. Both effects favor the desired shift of blood from areas where it is not needed in large amounts at the moment to areas where an abundant supply is needed. Thus the blood is shifted from one area to another.

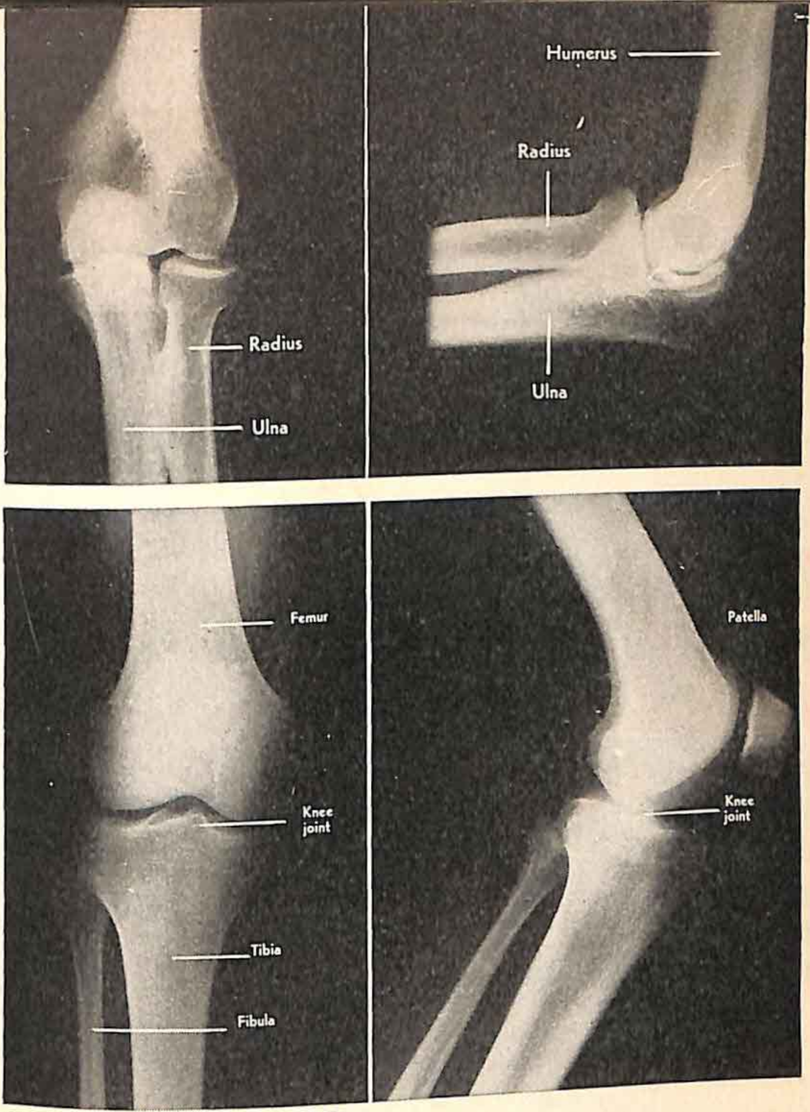
Left: Courtesy Emma Willard School, Troy, N. Y.
Right: Courtesy Northwood School, Lake Placid Club, N. Y.

GOOD FORM in sports involves muscular control.

cles working together form the neuromuscular system. When a muscle fiber cell is stimulated by the nerve impulse, its shape changes, growing shorter and thicker, but not increasing in general size.

Muscular energy. Activity calls for an expenditure of energy which comes from the oxidation of food. The energy-producing foods are starches, sugars, fats, and proteins. Starch and sugar are most readily utilized. The food digested from these is delivered in solution to the muscle cells by the blood. The blood in the arteries going to the muscles contains more sugar than does the blood in the veins returning to the heart. This fact has led modern athletic trainers and coaches to recommend sugar and sweets in moderation as a part of the regular diet for athletes. Training rules in the past called for rigid abstinence from all sweets.

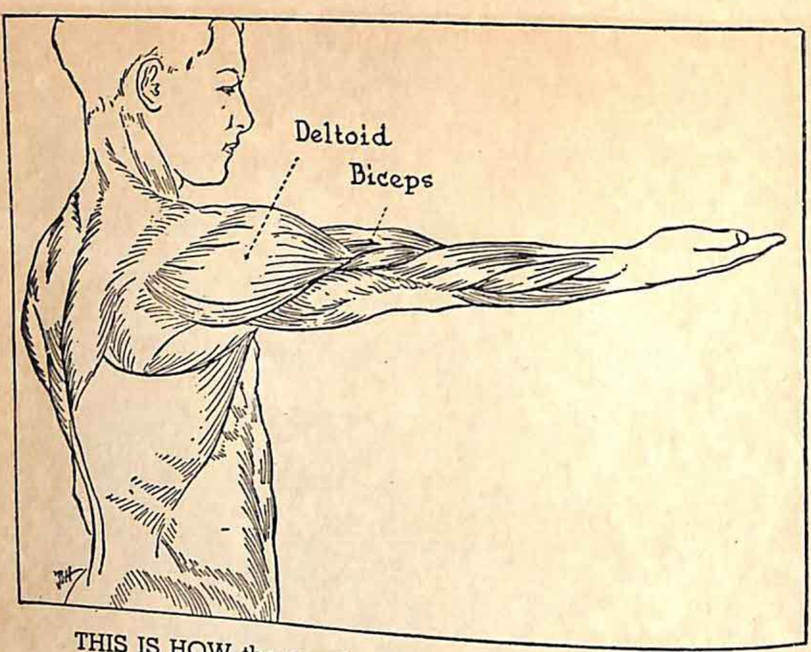
Need of exercise. Exercise is necessary for developing and giving tone to the muscles. Muscles develop through use and become flabby when allowed to remain idle a long time. Strong



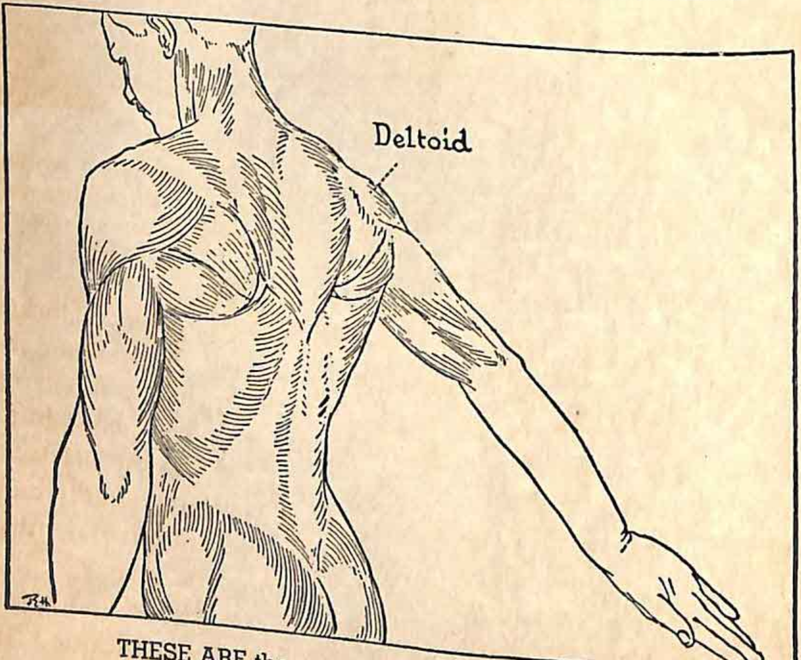
Courtesy Frank B. Stephenson, M.D.

HOW THE BONES fit together at the joints, making movement of the parts possible, is shown in these X-ray pictures of the elbow (*top*) and the knee (*bottom*). The two pictures of the elbow show the arm extended (*left*) and the forearm bent at a right angle (*right*). The pictures of the knee show the front view (*left*) and the side view (*right*) with the knee bent to show the knee cap (patella).

voluntary muscles give bodily power. Exercise should develop harmonious action between muscles and nerves and teach one to use muscles easily and effectively. This harmonious action is known as co-ordination (see p. 286).



THIS IS HOW the muscles appear when the arm is raised.



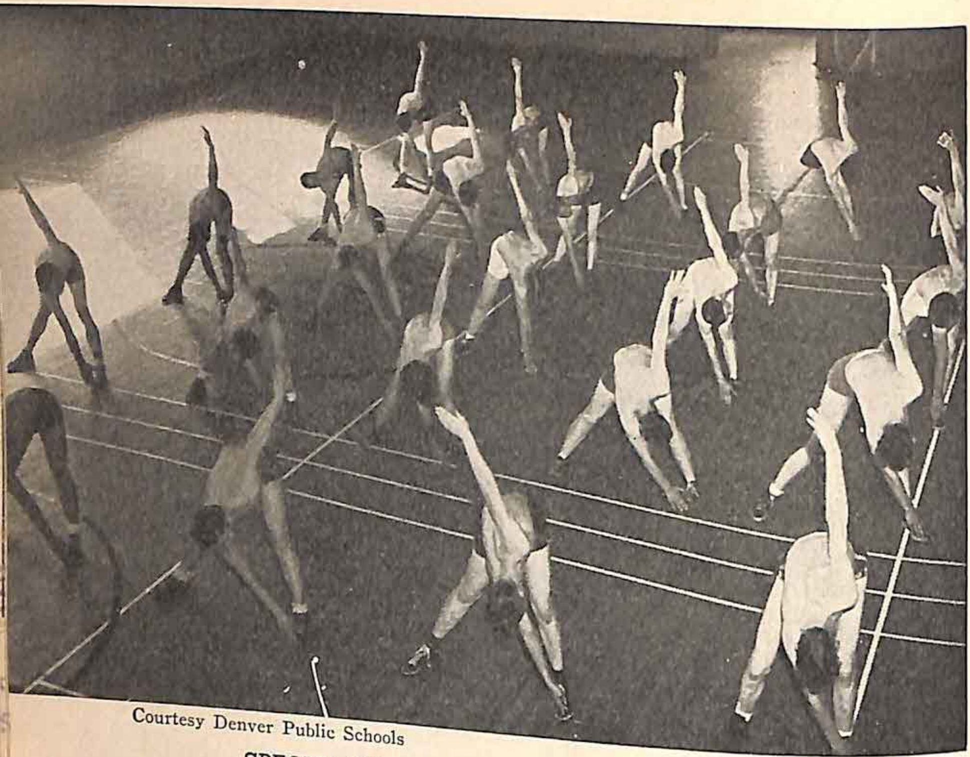
THESE ARE the muscles used in extending the arm.

Courtesy Look Magazine

MUSCULAR CO-ORDINATION and control are developed by regular exercise. The spirit of competition in a game and the fun of playing with friends make exercise easier and more interesting. Everyone should develop skills in a variety of active games.

Muscular exercise stimulates all the body functions. During exercise heart action and circulation throughout the body are increased. This results in a general speeding up in the supply of blood to all the organs. Digested food and oxygen are brought to the cells. Despite the greater cell activity, fewer waste products may be found in the blood because it is traveling rapidly and throwing off wastes. However, greater muscular activity is usually accompanied by an accumulation of fatigue poisons.

Exercise within reasonable limits improves digestion and helps to overcome constipation, headaches, and poor complexion. It



Courtesy Denver Public Schools

SPECIAL EXERCISES help in physical development.

clears the mind, steadies the nerves, and leads to better co-ordination of all bodily activities.

Activity program. There is no one perfect form of exercise. Various kinds of exercise are needed for all-round development and health. Physical activities should vary with the age and sex of the individual and should be adapted to the physical needs. A young person in good health who wishes to remain well must carry on some strenuous exercise each day. Older persons should continue to take some kind of muscular exercise, preferably of a recreational nature. Long periods of work and heavy responsibilities make it impossible for many persons to get as much recreational exercise as they had while in school.

Walk for health. Brisk walking in the open air is a good form of exercise for every healthy person. It is best to maintain erect posture, and to breathe only through the nose. An adult can keep in good muscular condition by taking a daily walk of about three miles. The greatest amount of benefit will be derived from the walk if it is taken regularly and as a recreation. An interest in the out-of-doors gives zest to the daily walk. Walking can also become a splendid exercise for young people. To be an active member of a hiking club is an excellent way to maintain such healthful activity. The best environment for any type of exercise is the out-of-doors.

Walking does not always satisfy all the physical needs of a normal young person. More active individual exercise, such as running, climbing, jumping, or vaulting, is necessary for complete development of the fundamental muscles. Programs of physical education include these exercises as a part of the regular class activity.

Physical fitness. Good games supply a mental and emotional stimulus that makes muscular exertion easy and enjoyable. One should develop an interest in outdoor sports that will continue in later life. Physical education offers group and individual sports which can be adapted to the physical needs of individuals of different ages. A single sport does not usually give training in all the fundamental motions, so a varied program of exercises should be sought. If the daily work does not require the use of a considerable number of muscles, exercises should be taken to supplement this lack. Setting-up exercises are good for those who cannot get any other form of physical activity during the day.

Games. Competition calls forth all the energy an individual has. For this reason, one should be very careful in choosing a competitive sport or game. An activity should be selected that will cause one to associate with those of about the same strength and endurance. In an easy game, further strength and skill are not so readily developed. On the other hand, a competitive game which is beyond one's strength gives no satisfaction and may result in injury to the body. Before taking part in any strenuous form of exercise, one should have a thorough physical examination to determine the condition of all organs of the body. There is no convincing evidence that a healthy heart is damaged by proper physical activity.

Courtesy Williston Academy, Easthampton, Mass.

BY JOINING a golf club, you can enjoy the outdoors as well as engage in a health-building activity.

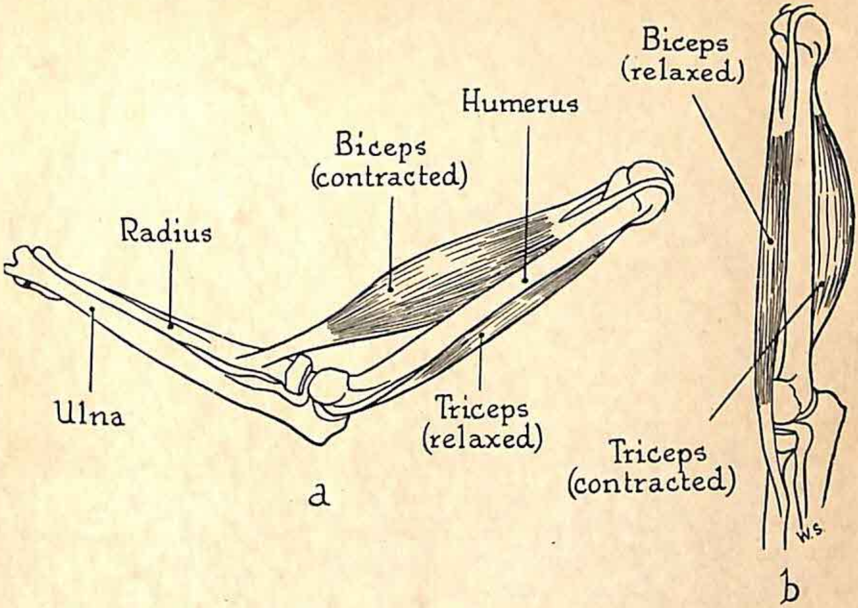
An interesting game or sport should be chosen for each season of the year. The normal person continues to enjoy physical activities after he leaves school. That exercise, properly chosen and regularly practiced, is a very important factor in maintaining bodily health and efficiency should never be forgotten.

In conclusion

MUSCULAR movements that are repeated again and again stamp their record on the body. Posture, facial expression, and efficiency are influenced. Regular exercise of the larger muscles benefits the entire body by keeping all the organs in good working condition. The object of physical exercise should be physical and mental efficiency.

Activities

1. Examine muscle cells. With dissecting needles tease apart a bit of tender steak (red-muscle tissue) on a slide in a drop of water. Under a compound microscope, observe the crossmarks on the muscle material. Do the same with a bit of heart muscle, and a bit of stomach muscle (tripe from the butcher shop). What are the differences in appearance?



IN BENDING the forearm upward (*a*), the biceps muscle is contracted—that is, it grows shorter and thicker—and the triceps muscle is relaxed—becomes longer and thinner. In extending the forearm (*b*) the reverse condition exists.

2. Study the relation between muscles and tendons. Get a chicken leg and foot from the butcher; slit open the skin, and free the ends of the tendons. Pull the tendons in front of the leg, then those behind, and note the effect on the movements of the toes. Do the tendons stretch?

3. Observe the use of muscles and bones. To what is the shape of your upper arm due? Clasp your left arm halfway between the elbow and shoulder; as you slowly move your left forearm up and down, where do the muscles contract (grow shorter, thicker, and broader) for bending the elbow? For straightening the elbow?

4. Note the changes in your circulation, respiration, and amount of perspiration after an hour of exercise out-of-doors.

5. How can you recognize skeletal muscles that are in good tone?

6. What physical activities are you planning to continue after school years? What sports do you engage in now, or what games do you play that can be used in later years?

7. Take a walk for half an hour and make a list of the things which attract your attention. Take the same walk a week later and make another list of things observed.

8. How is the program of physical activities in your school planned to meet the future needs of its graduates?

Test

Directions: On a separate sheet of paper write the numbers from 1 to 5, corresponding to the numbers of the statements given below. Place a check mark (√) to the left of the numbers of those statements which you think might reasonably be expected in the case described. From this chapter select the reasons for your choice and write them to the right of the numbers. Do not write in the book.

Marjorie was always the best student in her class. She was so absorbed in her books that she had little or no time for social and outdoor activities. She was nervous and looked undernourished. Her parents attributed this to overwork and so required Marjorie to come home immediately after school and rest two hours before beginning her homework. During her junior year she became acquainted with a boy who was very active in outdoor sports. Through him Marjorie became interested in tennis. Her enthusiasm for the game grew until she would often play tennis after school instead of going home for her afternoon rest. What do you think happened to Marjorie?

1. Because of lack of rest, she had a nervous breakdown.
2. Because of the increased activity, she developed a weak heart and had to leave school.
3. Since she spent less time studying, she lost her standing in scholarship.
4. Her nervousness disappeared, she gained weight, and required less rest.
5. Her homework became easier for her.

Associated subjects

Biology: How the body that radiates health depends on well balanced physical and mental development. . . . How exercise improves muscle development and body functions.

Home economics: The selection of proper clothing for sports and recreation. . . . The correct diet for exercise. . . . The value of exercise as an aid to digestion and elimination.

Physical education: The skills and co-ordination necessary for playing games. . . . The opportunity given to everyone to take part in some physical activity. . . . The social and emotional benefits derived from games, sports, and exercise drills.

Social science: The need for community recreation and play centers.

References

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CLEMENSEN and LAPORTE. *Your Health and Safety.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Films

How to Avoid Muscle Strains. 11 minutes, sound. Bray Studios.
Muscles. 15 minutes, silent. Encyclopaedia Britannica.

18. REST AND SLEEP RENEW OUR BODIES DAILY

FATIGUE is the natural result of activity and has been experienced by everyone. Only when activity is too prolonged and fatigue becomes too great is any harm done. A certain amount of fatigue is desirable. Strength is not built up unless activity is continued long enough to cause some fatigue. During periods of rest or sleep, ordinary fatigue disappears. If rest is not sufficient to allow recovery, fatigue poisons accumulate and general body health is lowered. One should guard against excessive fatigue.

Do you know . . .

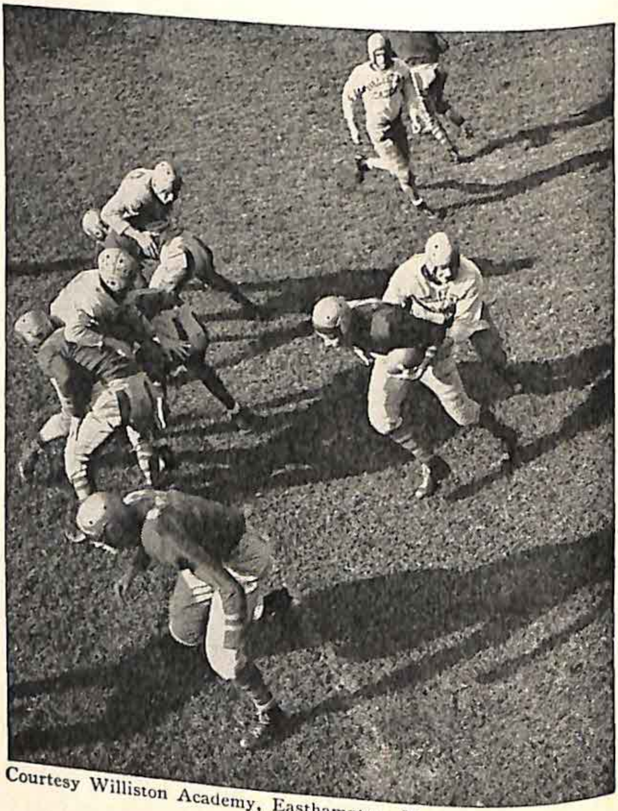
1. What is the nature of real fatigue?
2. How mental fatigue differs from physical fatigue?
3. How worry causes fatigue?
4. What are the dangers of overfatigue?
5. If all people require the same amount of sleep?
6. What causes insomnia?
7. What are the best hours for sleep?
8. Why relaxation is important?
9. How a change of work affects fatigue?
10. How rest and sleep counteract fatigue?
11. How unnecessary fatigue in the industrial worker can be prevented?
12. How fatigue poisons are formed?
13. How glycogen is used by the body?
14. What causes fatigue to disappear?
15. When fatigue becomes a serious menace to the worker?
16. Some of the conditions that bring on industrial fatigue?
17. How work shifts may disturb health habits?
18. What mental states tend to build up fatigue?
19. What part of every twenty-four hours should be spent in sleep?
20. What conditions in the surroundings interfere with sound sleep?
21. How one can learn to conserve energy?
22. How a person should be guided in selecting his activities?
23. Why modern living demands especial need for rest?
24. That drugs to induce sleep should be avoided?

Fatigue poisons. An important substance called *glycogen* is present in muscles. This is a starchlike substance formed from the sugar of the blood. During rest, the muscle stores glycogen within itself. In muscular contraction, oxygen unites with this compound to produce the necessary energy for work or activity. The oxidation of glycogen forms lactic acid, which is known as *fatigue poison*. During violent exercise, the need for oxygen becomes so great that a sufficient supply cannot be furnished even with the increased respiration and circulation that occur. Lactic acid accumulates in the muscle and a tired feeling results. If many muscles or muscle groups are used, large quantities of lactic acid escape into the blood and cause a feeling of tiredness or fatigue throughout the body. Besides the fatigue poisons produced in the muscles, there may be other poisons absorbed into the blood from the digestive or respiratory tract or from general or localized infection.

Food, the source of energy. During rest, oxygen unites with a part of the lactic acid, setting free energy, some of which is used to change the rest of the lactic acid back into glycogen. With this reformation of glycogen, fatigue disappears. After violent exercise ceases, additional oxygen is still required for immediate cell needs; hence, rapid breathing continues until these needs are supplied. During ordinary work or exercise, the supply of oxygen is sufficient and the lactic acid is oxidized at the same rate at which it is formed, so that little fatigue is felt. Since a part of the glycogen is used up completely in the change to lactic acid and back to glycogen again, there must be a constant supply of food to replace the amount thus lost. The blood supplies the food and oxygen necessary for activity.

Mental fatigue. Little is known about the nature of mental fatigue as compared with the knowledge of muscular fatigue. Nerve impulses seem to require little energy; hence, nerves can carry impulses for a long time without much fatigue. There is little scientific knowledge as to the exact cause of mental fatigue. The condition thought to be mental fatigue is usually muscular fatigue caused by a person sitting for a long period of time without a change of position. A remedy for this type of fatigue is exer-

Courtesy George School, George School, Pa.



Courtesy Williston Academy, Easthampton, Mass.

IN THESE two favorite national sports thousands are thrilled annually to witness plays of breath-taking rapidity—where the split second counts! Mind and muscle co-ordinate with lightning-like speed. Behind these brilliant plays are long periods of careful training; proper rest and sleep; and nourishing food.

cise. Through exercise blood is forced from the brain into other parts of the body. The accepted belief is that one becomes stale, or physically tired *of* mental work, and not tired out *by* it. The so-called mental fatigue from study results from eyestrain or poor posture, plus staleness or lack of will. Mental activity alone is not the cause of a breakdown in health. The poor health of the "grind" or "bookworm" is not due to mental strain but to bad habits of living, such as lack of exercise, late hours, and poor nutrition.

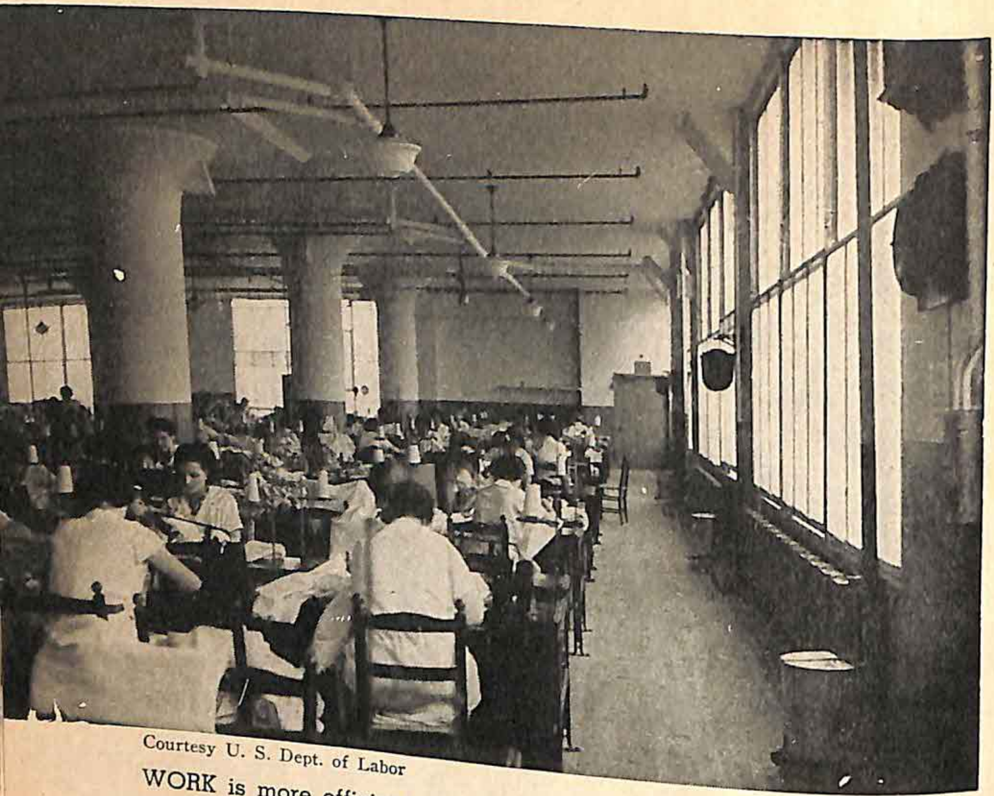
Effect of emotion on fatigue. Violent emotional shock or strain may have much the same effect on the body as violent exercise. Under such strain the body becomes tired out. On the other hand, a strong emotional stimulus may cause an already fatigued person to exert greater energy. An anxious mother ministering to a sick child will, during the crisis, watch day and night by the bedside without rest, but is likely to collapse when the strain is over.

Industrial fatigue. Industrial employers are realizing more and more that if they wish to operate with profit they must maintain the health and efficiency of the worker. They are becoming increasingly aware of the part that fatigue plays in productive work. The effectiveness of the worker demands that all unnecessary fatigue should be avoided.

There is a normal fatigue which comes from the day's work and disappears after a night's rest. Fatigue that accumulates from day to day becomes a menace to the health of the worker.

Muscular fatigue occurs when the muscle fibers are used excessively and the stored food in the muscles becomes exhausted and wastes accumulate. Unless the body is allowed to rest and the lost food is restored, the maximum efficiency of the worker gradually declines.

In a study of work records of employees throughout the day, it has been found that efficiency declines toward the latter part of the morning, improves after lunch, and declines more rapidly in the afternoon. Accidents are also most frequent during the periods of accumulating fatigue. Fifteen-minute rest periods in midmorning and midafternoon result in increased efficiency. It



Courtesy U. S. Dept. of Labor

WORK is more efficient and fatigue is less in a well-lighted and well-ventilated factory.

was also found that the need for food delayed recovery from fatigue. Some factories have lunchrooms where their employees can get wholesome food at small cost and rest rooms where they can relax or lie down for a few minutes during the working day.

Fatigue can be reduced by the avoidance of waste motion in the use of tools. In some occupations a definite rhythm of movement tends to lessen fatigue.

There are influences outside the factory which induce fatigue. Poor housing and living conditions may not provide suitable opportunity for rest. Transportation to and from the factory may be a source of fatigue. Bad habits of living may prevent suitable recreation and the maintaining of physical fitness.

Every industry should provide good working conditions.

Among these are enough light for efficiency and comfort, ventilating systems that will remove dust and fumes and provide the best temperature for working, and a reasonable length of the working day. Work that involves great muscular effort, intense mental concentration, or extremes of heat, cold, or other physical conditions should be limited to a relatively small number of hours of daily work.

Work shifts. In industries that operate continuously during the twenty-four hours of the day, there are usually three successive shifts of workers. The person who works during the nighttime may have difficulty in becoming adjusted to a new routine. His customary daytime schedule of work, meals, rest, and recreation must be changed, and his health habits are disturbed. It has been repeatedly stated that several weeks may be required for a person to become accustomed to such a change in schedule. However, in recent war activity there was evident a distinct tendency to ignore this point of view.

For the individual exposed to the alterations of such time schedules, it may be well to emphasize the importance of avoiding resentment to disturbing sounds. Also important is a careful planning of the mealtimes, sleeping hours, and leisure activities so as to favor the mental and bodily relaxation necessary as the time for sleep approaches.

Effects of fatigue. Those who are continually overfatigued lose their healthy good looks, enthusiasm, energy, and mental alertness, and are less able to get on with others. There is considerable evidence too that fatigue lowers resistance to disease and that it interferes with recovery from infections.

If one feels well, sleeps well, eats well, and is happy, there is little danger of overdoing steady activities, even though one may feel tired out at the end of the day. The amount of work that can be done in a day varies with, and should be determined by, the capacity of the individual. However, strength to do more work can be built up. Often doing too many trivial things consumes energy needlessly, so that little strength is left for the necessary tasks.

One of the surest ways to develop fatigue is to nurture a feeling of disgust or resentment toward the work that is being done, or of irritation toward those with whom one works. Any form of mental vexation or irritation decreases efficiency and increases the tendency to fatigue.

Frequent change of work is a desirable way of reducing fatigue, since new sets of nerve and muscle cells are used, giving the tired cells a chance to recover their normal state. Variety also gives pleasure. It should be remembered, however, that when one is already physically tired, even pleasurable activity may add to fatigue. Work, play, and social life should all have a part in the daily program. The activities selected should be within the power of the individual and should be carried to completion without undue fatigue.

Sleep, a restorer. The wise individual does not use up all of his power without providing for its renewal and repair through sleep, rest, and proper nutrition. Of all the methods of getting rest, sleep is certainly the most efficient. We spend, or should spend, about a third of our lives in sleep. Sleep usually occurs when the muscles are relaxed and the eyes closed to the stimulus of light. Sleep seldom occurs unless it is needed. Body repair and growth also take place during sleep, when the demand for energy for other purposes is low. The amount of sleep needed is to some extent in proportion to the use of energy for activity and growth. A very young baby should sleep twenty-two out of the twenty-four hours; a child, from eleven to fourteen hours; a high school boy or girl, from nine to ten hours; an adult, from eight to nine hours. To gain weight, the amount of sleep should be increased, as well as the food. Too little sleep results in loss of weight, good looks, and energy, and often leads to illness. For example, the common cold is much more easily acquired when the individual has not been getting enough rest and sleep. The hours of sleep should be regular. Going to bed at a regular hour is a great aid to falling asleep, because one develops the habit of becoming sleepy as that time approaches. Besides irregularity in the time of going to bed, other factors that interfere with sleep are light, physical discomfort, unusual noises, overeating, worry, and too much excitement during the evening. Above all, a person should, if possible, rest whenever tired and not wait for bedtime to come.

The surroundings for sleep. The bed should be comfortable. It should have a level, firm mattress. The room should be dark but well ventilated. The position assumed by the body when going to sleep is of little concern. Any position that is comfortable and in which the body can relax will induce sleep. The position of the body changes many times during the sleep.

Nearly everyone dreams, but generally the dreams are not remembered and have no significance. Dreams are of very short duration; a long, complicated dream takes place in a few seconds, usually just before waking. The sleep that is most restful is free from dreams.

Going to sleep is a habit in which everyone should train himself from early youth. Sleep should come easily to the healthy body. If one finds it difficult to get to sleep, a short, moderately brisk walk or a glass of warm milk before going to bed may help. Counting sheep or any other device that breaks the fixed trend of thinking will sometimes bring on sleep. Drugs that induce sleep should never be used unless prescribed by a physician. If sleep does not come readily, one should not be fearful, for one always drops off to sleep sooner or later. It has been well said that the best way to obtain sleep is not to desire it too much. After all, relaxation of the body is a very important factor. This can take place almost as well when lying awake as when asleep.

Conservation of energy. Many very active persons have learned to conserve body energy by taking short rest periods or even short naps during the day. Moderate fatigue can often be overcome by a short rest. Sometimes a change of activity or occupation is all that is needed. Many physicians are now advocating that boys and girls observe periods of rest as regularly as they do periods of sleep. Periods of relaxation are necessary in maintaining health and vitality.

In conclusion

IN OUR modern world the noise and rush of industry makes it more essential than ever before that the body be given sufficient opportunity to restore itself through rest and sleep. Also, perhaps, through learning how to conserve energy and slowing down activity, we can get a little more out of life as we go along.

Activities

1. Under the headings, "Wholesome" and "Unwholesome," list the activities of the past week which have contributed to cause your fatigue.
2. Budget your time for the next week including rest, mealtime, mental and physical activity.
3. Describe your mother, your best friend, and yourself when each is well rested and when each is fatigued physically and emotionally.
4. Compare the value of complete rest with that of change of activity in avoiding fatigue. Which factors are primarily emotional? Which primarily physical?
5. Discuss the efforts made by employers in your community to introduce play into the free time of their employees.

Test

Directions: Is your day's schedule so planned that you may avoid undue fatigue? On a separate sheet of paper write the numbers from 1 to 24, corresponding to the numbers of the questions given below. After each number write the word *Poor, Fair,* or *Good* according to your judgment of your own practice. Do not write in the book. Perhaps some of the practices in which you are deficient may be due to conditions which you cannot control at present. You should keep the correct standards in mind, and, as the opportunity for change presents itself, aim at improvement.

1. Do you spend nine to ten hours in bed at complete rest or asleep?
2. Do you sleep alone in a quiet, dark, cool, well-ventilated room?
3. Do you wear suitable night clothing?
4. Do you adjust bed clothing in accordance with the weather?
5. Do you rise in time for morning preparations (bathing, breakfast, putting your room in order, journey to school)?
6. Do you eat meals at regular times every day?
7. Do you rest at least ten minutes during the middle of the day?
8. Do you enjoy the feeling of vitality that follows adequate rest?
9. Do you prefer hours of sleep to staying up late for such reasons as studying, going to the movies, parties?

10. Do you know when you have had a sufficient amount of exercise, play or work, and rest?
11. Do you know that to feel comfortably tired at night and rested in the morning are important health signs?
12. Do you have regular toilet habits, with at least one bowel evacuation a day?
13. Do you take a warm bath at least once a week?
14. Do you take a shower after violent exercise?
15. Do you aim to wear clean clothing by frequent changes of stockings and underwear?
16. Do you wear comfortable clothing and shoes?
17. Do you have a regular time for home study, not after 10:00 P.M.?
18. Do you have a quiet room for study?
19. Do you read and study by a steady light without glare?
20. Do you try to keep the temperature of the room not over 70° F.?
21. Do you avoid movies and parties during the school week?
22. Do you have music, games, and good reading in the home?
23. Do you keep your voice subdued and control your irritating activities in the home (avoid quarreling)?
24. Do you engage in a favorite hobby?

Associated subjects

Biology: How physical activity causes fatigue. . . . The need of counteracting fatigue poisons through rest and sleep.

Chemistry: The evaluation of the dangers of sleeping medicines.

Home economics: The selection of a bed, bedding, and sleeping clothes. . . . The influences that induce or disturb sleep.

Physical education: Rest periods to overcome fatigue from games and all forms of athletics. . . . Sleep as a regular part of training.

Social science: The value of rest periods for both employees and employers in increasing efficiency in the industries. . . . The need for recreation centers to keep the body healthy.

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19. YOUR NERVOUS SYSTEM DIRECTS YOUR LIFE

YOU live in a world of matter and energy. Your body is not a lifeless machine working at the same rate all the time, but a responsive, living organism, behaving differently as conditions change. Food, temperature, atmospheric pressure, disease germs have much to do with your comfort and well-being. Besides these conditions on the outside, there are also influences acting within your body. Your comfort and happiness depend on the way in which you react physically and emotionally to all these conditions.

Do you know . . .

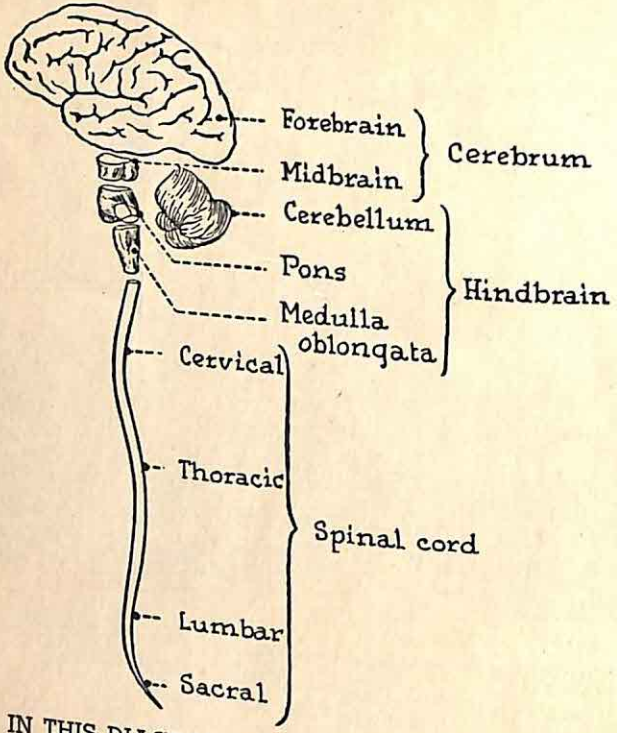
1. The importance of the nervous system?
2. What gray matter is?
3. What is the difference between a nerve cell and a nerve fiber?
4. How the brain controls the activities of the body?
5. What reflex action is?
6. How nerve cells become connected?
7. Why inhibitions are important?
8. Upon what the health of the nervous system depends?
9. How habits are formed?
10. How we learn?
11. What part of the nervous system controls the lungs, the heart, the stomach, and the kidneys?
12. How the emotions affect one's well-being?
13. Why a healthy nervous system is so important?
14. How sleep counteracts nerve fatigue?
15. What internal secretions are?
16. How the ductless glands influence body growth?
17. What disturbances may occur in the body if any of the internal secretions are lacking?
18. How the brain is protected?
19. What the autonomic nervous system is?
20. How alcohol affects the nervous system?
21. Why iodine is an important element in the body?
22. How emotional excitement affects the adrenal glands?

Courtesy H. Armstrong Roberts

THE NERVOUS system may be compared to a system of telephone wires leading into a central exchange—the brain. Communication is broken down whenever any part of the system is damaged.

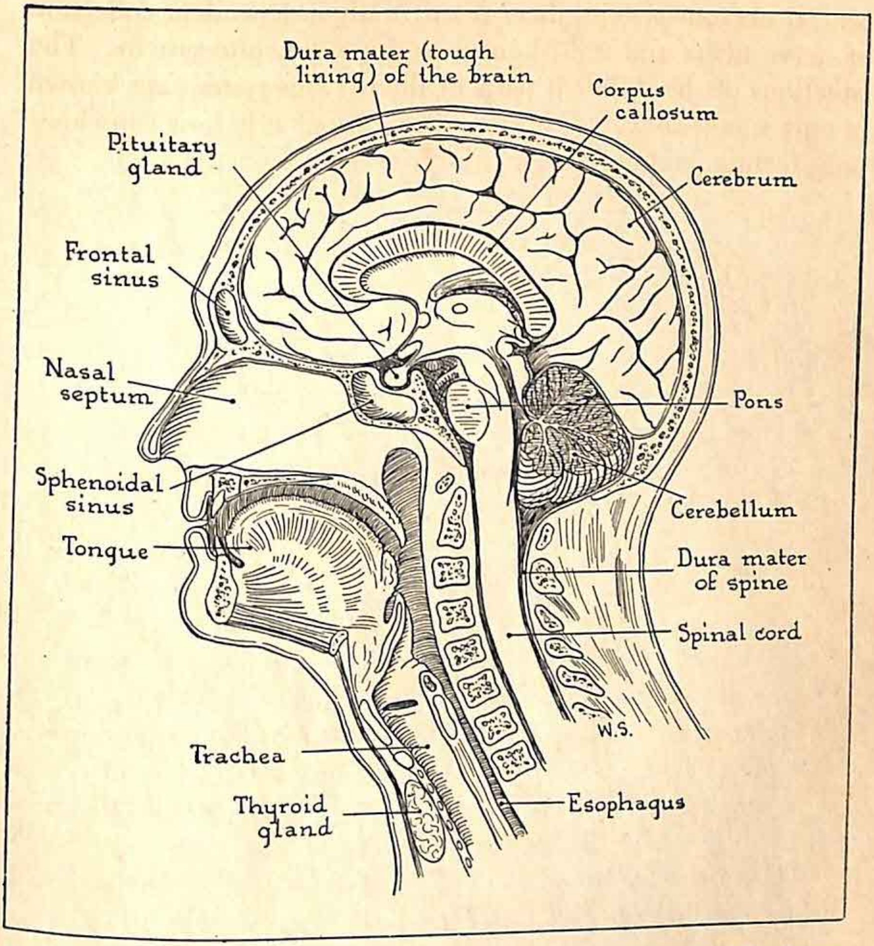
The nervous system. As we work, play, eat, and sleep, the organs of our body must operate together. Each organ, as it responds to stimuli, depends upon the work of all the other organs. Teamwork or co-ordination is the keynote to successful activity in the body. Adjustment to conditions outside of the body must also be constantly made. Adjustment and internal co-ordination require means of communication between various parts of the body. This is provided by the various complicated structures which make up the nervous system.

The central nervous system is composed of the brain, the spinal cord, and the nerves branching from them. In addition to the central nervous system, there is a partially independent collection of nerve fibers and cells, known as the *autonomic* system. The functions of the different parts of the nervous system are known in only a general way. No scientist has proof as to how consciousness, feeling, and will-power arise from nervous activity.



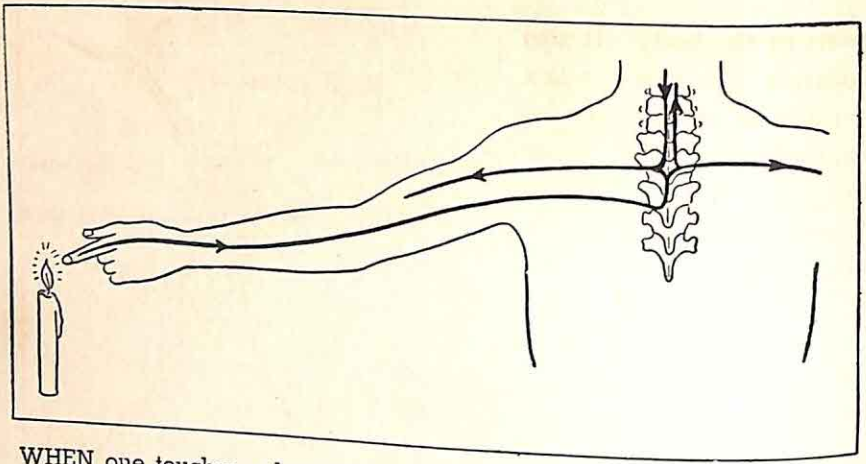
IN THIS DIAGRAM of the nervous system the various parts of the brain and spinal cord have been separated from one another.

The brain. The brain of man fills the inside of the skull and weighs nearly three pounds. It is surpassed in weight only by the brain of the whale, which weighs five pounds, and by that of the elephant, which weighs about eight pounds. The size of the brain varies greatly in different animals. It is generally larger in the more intelligent animals. In man, the many grooves and wrinkles on the surface of the brain are more fully developed than in the lower animals.



A MIDSECTION view through the head and neck shows that the brain is protected by the bones of the skull, and the spinal cord is protected by the bones of the spinal column.

The brain is protected by three membranes: a tough lining next to the skull; a thin, delicate covering, which carries blood vessels, next to the brain; and a third very thin membrane between these two. Between the two inner membranes is a space filled with a clear fluid which serves as a cushion against jars or injuries. The outer surface of the brain consists of gray matter containing nerve cells around which fibers end or which give rise to nerve fibers. The inner part of the brain is made up of a com-



WHEN one touches a hot object, the muscles of the arm jerk the hand away before the sensation of pain is felt.

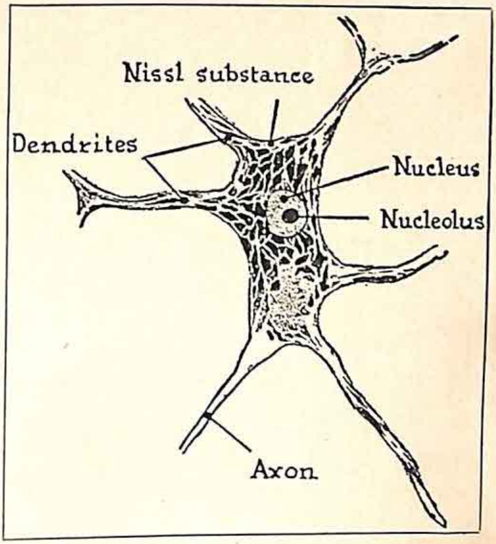
plicated network of white nerve fibers, running to and from the gray matter.

The largest part of the brain is the forebrain or cerebrum. Its dome-shaped surface is covered with many deep grooves and wrinkles called *convolutions*. It is the seat of interpretation of the special senses, such as seeing, hearing, smelling, and tasting. The cerebrum also controls voluntary actions and is believed to be the seat of thinking, reasoning, and remembering.

The part of the brain underneath the back part of the cerebrum is the cerebellum. It serves in co-ordinating the actions of the muscles, that is, making them work together. For example, in walking, dozens of muscles are used; if they did not all work in harmony (co-ordination), one could not walk.

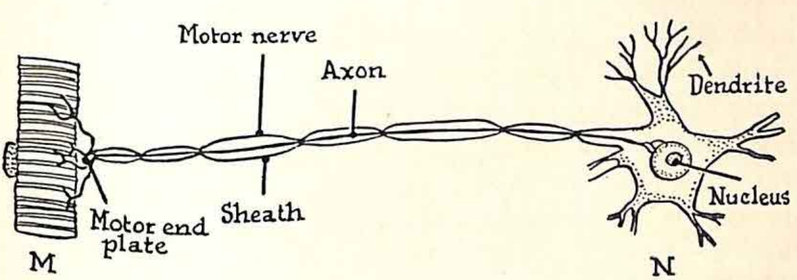
Beneath the cerebellum lies the spinal bulb or medulla, the lower end of which is continuous with the spinal cord. The spinal bulb controls involuntary activities, such as breathing and circulation.

The spinal cord. The spinal cord extends from the base of the brain to near the lower end of the backbone. The entire distance from the brain to the hands or feet is not spanned by any single nerve fiber but by a succession of them. The spinal cord serves to convey nervous impulses between the brain and most parts of the body. It also controls the many reflex actions or involuntary responses to stimuli. There are times when it takes too long for the brain to act, so the body requires a quicker governing power to supply its needs or to protect it from injury. Through *reflex actions* nature acts quickly to protect the body. Blinking the eyes at the approach of an object, dodging missiles, or pulling the hand or the foot from danger are a few examples of reflex action that aid in safety. The response in a reflex has to come so quickly that there is no time for thinking the matter over. In the spinal cord each muscle has its own set of cells which connect it with the brain.

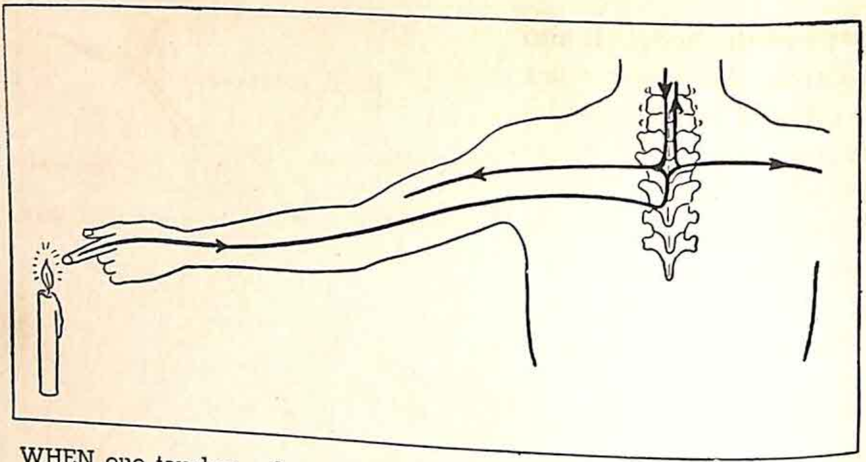


THE PARTS of a nerve cell are dendrites, axon, nucleus, and nucleolus.

Nerve cells and nerve fibers. Nerve tissue is made up of highly specialized cells. From each nerve cell or *neuron* there usually extend one long fiber and several short ones. The short fibers



A MOTOR NERVE cell or neuron (*N*) consists of a cell body with nucleus, short branches—called dendrites—and a long nerve fiber—the axon—which is covered with a protective fatty sheath. The axon terminates in an end plate of tiny branches which are attached to a muscle (*M*).



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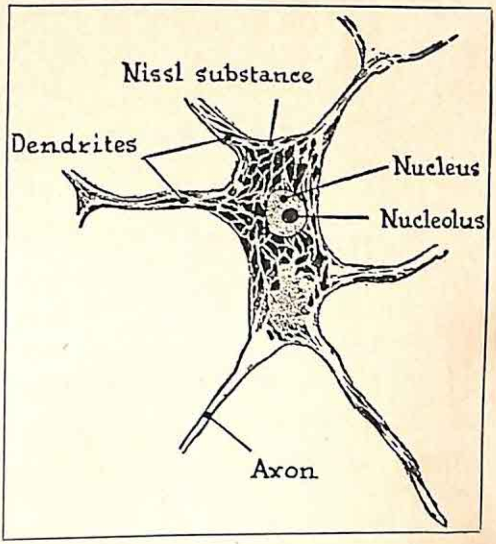

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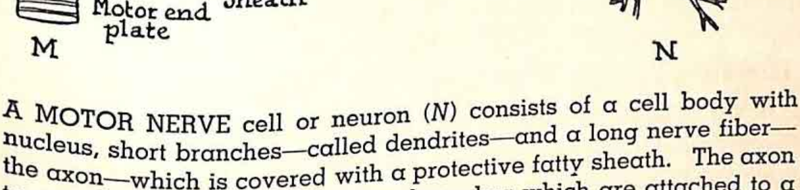

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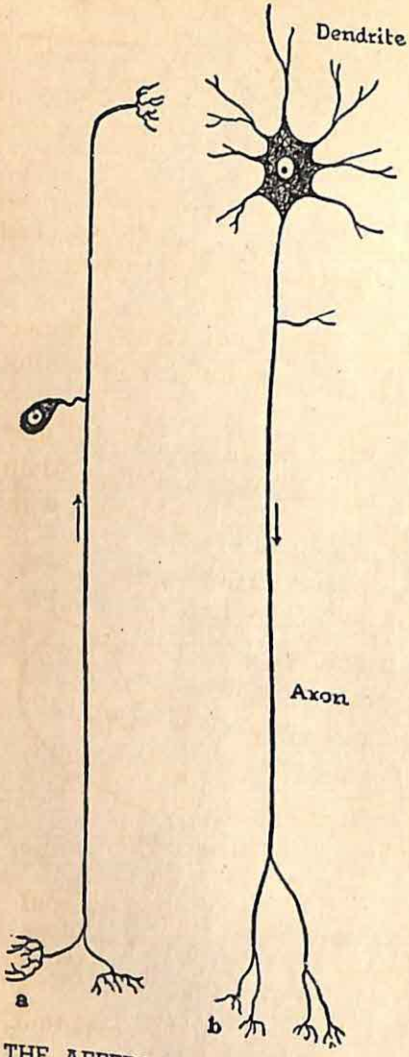
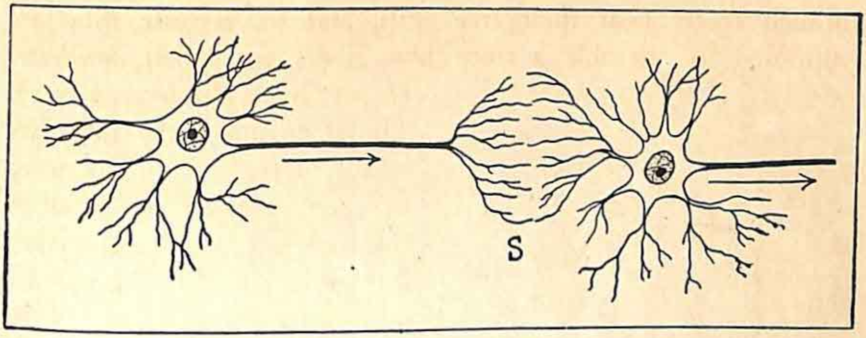
branch freely near their free ends, and so, because they are supposed to resemble a tree, these fibers are called *dendrites* (from Greek *dendron,* a tree). The dendrites carry impulses to the nerve cell. The long fiber or axon carries impulses from the nerve cell and makes contact either with a muscle or with other nerve cells, or with sensory end plates, such as the organs of feeling in the skin, the taste buds in the tongue, and the organ of hearing in the internal ear. Nerve cells are grayish white, and nerve fibers appear white because they are covered with white sheaths.



THE AFFERENT or sensory neuron (*a*) carries impulses from a sense organ to the central nervous system. The efferent or motor neuron (*b*) carries impulses from the central nervous system to some organ.

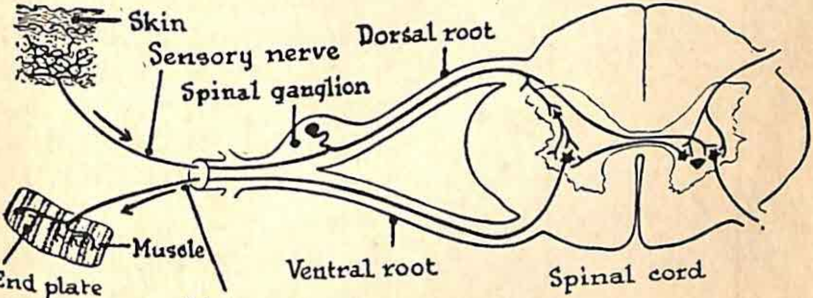
The nerve cells are formed in definite numbers during the early development of the individual, and never increase in number after the age of about three years. If nerve cells are destroyed by disease, such as infantile paralysis or injury, they do not regenerate. Nerve fibers which conduct impulses can regenerate, providing the cells from which they spring are not injured. When a nerve is cut, those portions of the fibers left in connection with their nerve cells, remain normal; while the parts that have been disconnected undergo degeneration. Under certain favorable conditions the injured



A SYNAPSE (S) is the point where first all the connections are open and where finally the ends of one neuron connect with those of another.

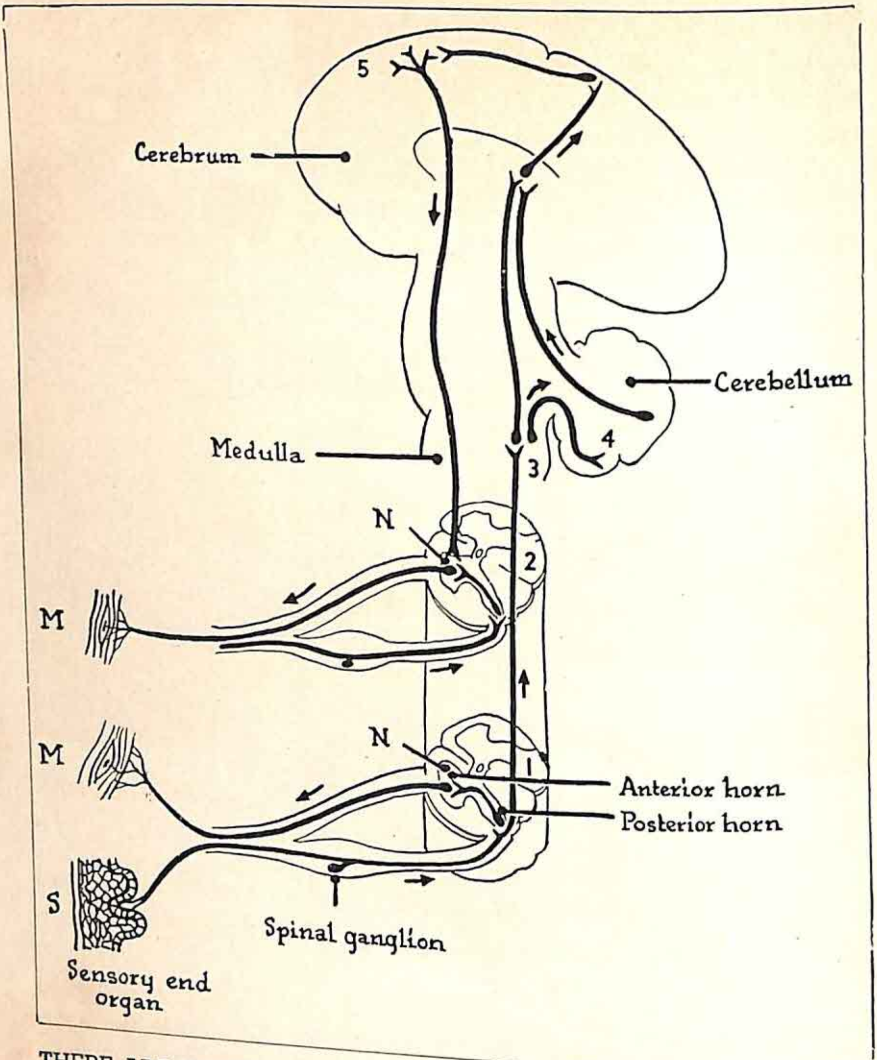
end of a nerve may grow new fibers and establish former connections. Such regeneration, however, is a very slow process taking months or even years.

The gray matter of the brain or that of the spinal cord may act either as a governing center or as a receiving center. Certain small areas in the cerebrum are connected by nerve threads with



THE REFLEX ARC is created by converting sensation (from the skin) into motion (in a muscle placed near by). This is what takes place when one touches a hot object.

the particular parts of the body which they govern. For example, when the thumb is to be bent, cells in a certain spot at the top of the brain send impulses over nerves to the muscles of the thumb and cause them to contract. Other cells in the gray matter receive impulses over nerves from the sense organs, such as the eye, the ear, and the nose. Each small spot in the skin has its own re-



THERE ARE MANY nerve paths to and from the brain. An impulse that arises in the sensory end organ in the skin (S), muscle, tendon, or joint has many pathways open to it. It may be transferred to a sensory neuron in the spinal cord at the same level (*1*) or at a slightly higher level (*2*); or it may reach the medulla (3), the cerebellum (4), or the sensory level (5) in the cerebrum. Regardless of the path taken, however, the impulse eventually reaches the motor nerve cell (*N*), from which it passes to the motor end plate of the muscle cell (*M*).

Courtesy Harold M. Lambert

THE SPECIAL skills shown here are the result of concentration and long, continued practice.

ceiving center in the cerebrum to which its sensory end plates send impulses when touched or when receiving a warm or cool stimulus.

The point where the impulse is conducted from one nerve to another is called a *synapse*. The simplest connection between stimulus and response takes place in a reflex act in which the response occurs involuntarily, although the brain may be conscious of the event when it occurs. In such a case, the synapse is between a sensory cell and a motor cell in the spinal cord, and the cells in the brain are not concerned with the action that results, except sometimes in recording the event.

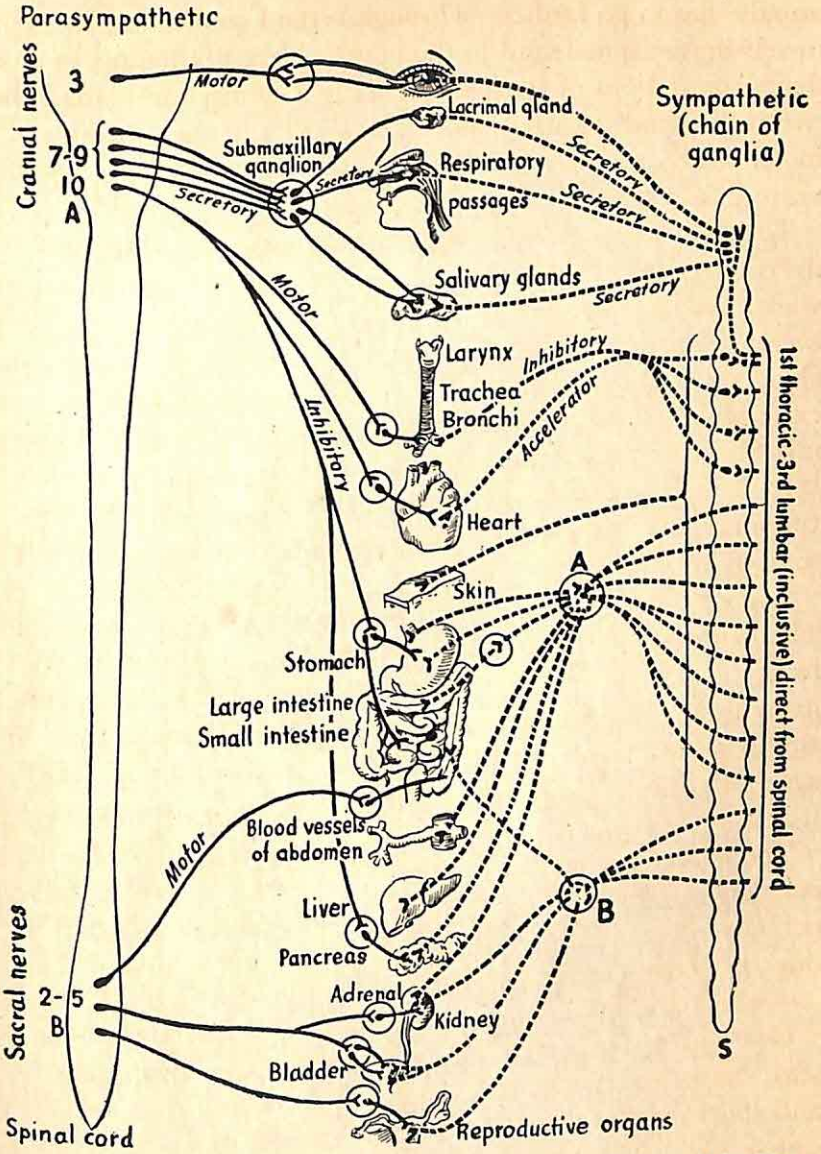
How we learn. In the process of learning, the pathway of the impulse is more elaborate and complicated than for a reflex. The impulse has to go farther. Through certain connecting nerves it travels up the spinal cord to the brain. Here it attempts to cross many connections of synapses. Finally a connection is made between the dendrite of a sensory nerve cell and the processes of a motor nerve, and the message or impulse goes out over another nerve in a response.

The first time a tie-up in the learning process is attempted, all the connections of the nervous system are open. The direction in which the impulse goes is therefore a matter of chance. However, after the act has been performed a few times, the pathways along which the controlling impulses have passed set a pattern for exact repetition of the action the next time the same stimulus is given. The resulting movements at first are slow and awkward. If repeated many times, they become easy, graceful, and less purely voluntary. Ultimately all connections, except the one to be used, seem to be closed.

A great many synapses are involved in learning a new skill. The best way of training the neuromuscular system to act perfectly in a well-directed manner is to repeat the same motion many times. By practice, mental and motor skills are developed and habits are formed. To stand erect, to play football, to manage a machine, to draw a beautiful picture are skills that are perfected by repetition.

The autonomic system. Many life activities, such as the circulation of the blood and the digestion of food, usually go on without our consciousness. These activities are automatic and are directly under the control of small, autonomic (self-active) centers which are connected with the spinal cord and with the brain.

One part of the autonomic system, called the sympathetic system, consists of nerves and ganglia that are found in the thorax and abdomen and are connected with nerves that come from the spinal cord. Their main function is to stimulate and accelerate the activities of the heart, the digestive organs, and the glands of the body. On the other hand, there are two other groups of nerves and ganglia which restrain the activity of the organs that the sympathetic system hastens. One of these groups is located along the cranial nerves near the base of the brain and the me-



THE AUTONOMIC nervous system, the regulator of internal bodily activities, has two parts. One set of nerves acts on an organ in one way, and another set has the opposite action. For example, the parasympathetic nerves cause the salivary glands to produce more saliva, and the sympathetic nerves cut down the flow.

dulla; the other is near the lower end of the spinal cord.

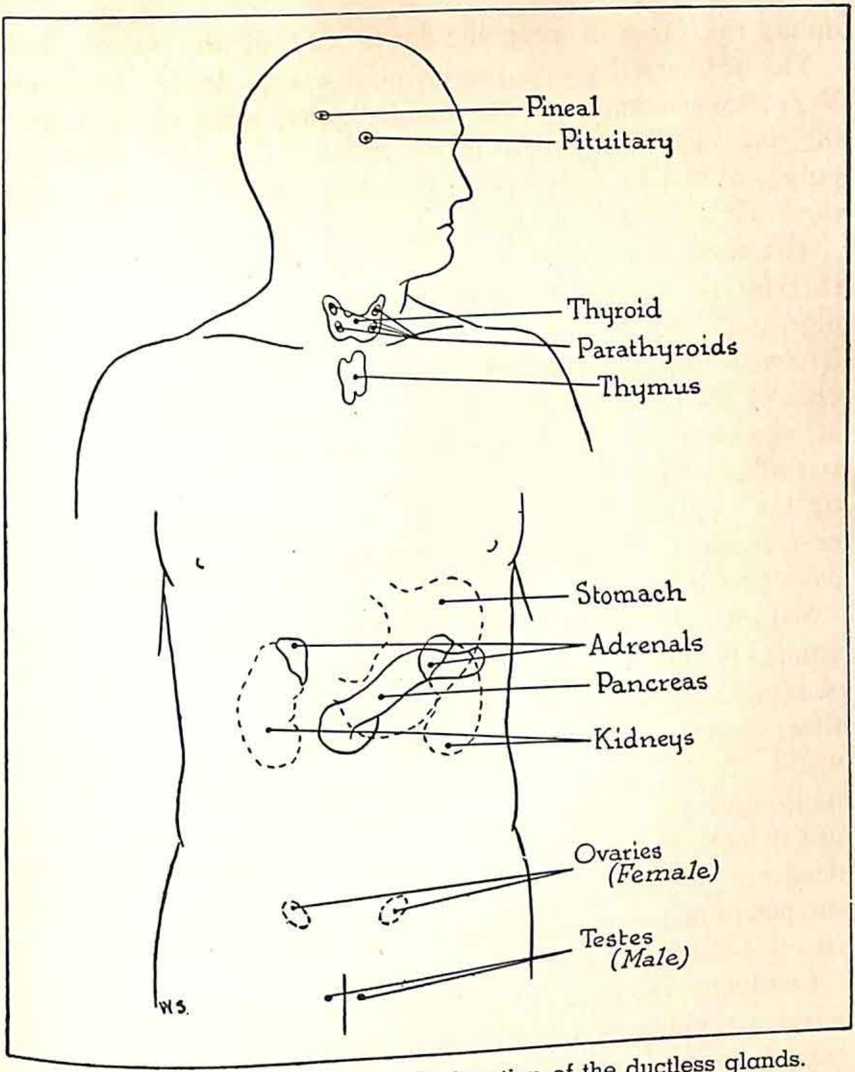
The ordinary digestive process produces no definite sensation. Very strong irritation in the digestive tract, as in colic or vomiting, may give rise to pain in the abdominal organs. Such impulses, caused by disturbances that may injure the body, reach the brain and make one conscious of the disturbance.

The effect of the emotions. Mealtime should be a happy and cheerful occasion, since emotional disturbances interfere with digestion. Impulses concerned in rage, anger, fear, or pain interfere with impulses supplying the digestive juices. All the processes of the body are assisted and accelerated by conditions that are cheerful. Happiness is a desirable stimulant. It aids in the learning process and helps to keep the body well. One should try not to give expression to feelings of disappointment, sullenness, or anger. They injure the body and at the same time make other people unhappy.

Self-control. Self-control is the ability to check or restrain action. It comes largely through the power possessed by the brain of restraining the spinal cells from sending out reflex impulses when strong and sudden stimuli are received from the outer world. A person whose brain is not exerting good control will jump suddenly if a door slams. The cultivation of *inhibitions* is just as important as the encouragement of reflexes. One great danger in the use of alcoholic drinks is their interference with the power of restraint, as well as with the power of prompt response to an emergency.

Conduct. We exercise the nervous system by training ourselves in conduct. Habits of clear thinking, of self-criticism, of courage, of unselfishness, or of happiness can be cultivated by practice, very much as the simple balancing reflexes are cultivated when one learns to ride a bicycle.

Chemical control of the body. Teamwork between the organs in the body is not entirely controlled by the nerves. It is also partly due to the direct effects of certain chemical substances called *hormones,* circulating in the blood (see p. 209). These hormones are produced by *ductless glands* known as endocrine glands or glands of internal secretion.



IN THIS DIAGRAM is shown the location of the ductless glands.

Knowledge concerning these glands is of recent origin and some of it is still in the experimental stage. Enough has been established, however, to make one realize that the health and development of children are dependent upon normal functioning of the ductless glands. The four best known ductless glands are the thyroid, the adrenal, the pituitary, and the pancreas. Others are the pineal, the parathyroid, the thymus, and the sex glands.

Courtesy Williston Academy, Easthampton, Mass.

ON A ROTATING cylinder is recorded the rate by which food is burned in a person. The machine measures the amount of oxygen consumed and the amount of carbon dioxide exhaled. The basal metabolism test detects any disturbance in the normal functioning of the thyroid gland.

The thyroid gland. The largest of the ductless glands is the thyroid, located in the neck on each side of the voice box. The hormone secreted by this gland increases the rate at which food is oxidized within the body, thus regulating the growth of the body. The activity of the thyroid gland is determined by what is known as a basal metabolism test. This test, by estimating the oxygen used or the carbon dioxide eliminated, measures the rapidity with which food is burned in the resting body.

If too much gland secretion is produced, the food burns too rapidly in the body; there is a speeding up of the pulse, the respiration, and other body functions; and there is an increase in nervous activity, which often causes underweight. If not enough secretion is produced, the food burns more slowly than is normal, causing obesity, or excess weight.

Even though the body requires only a very small amount of iodine, it sometimes fails to receive through food the supply which is needed for the thyroid secretion. In such cases, the gland may increase in size and show as a swelling in the neck. The disease is called simple, endemic goiter. Simple goiter is very common in parts of Switzerland, Michigan, Ohio, and Montana. In these areas the soil and the foodstuffs produced therefrom are unusually low in iodine content. Iodine added to the diet, as in iodized salt, may prevent the development of goiter in young persons. By adding small amounts of iodine to the diet in regions of endemic goiter, the occurrence of this disease has been reduced but not eliminated. Iodized salt, as sold, varies in its iodine content. The universal use of iodized salt is not recommended, since all regions are not equally deficient in iodine. One may suffer from either too much or too little iodine in the diet.

Courtesy Williston Academy, Easthampton, Mass.

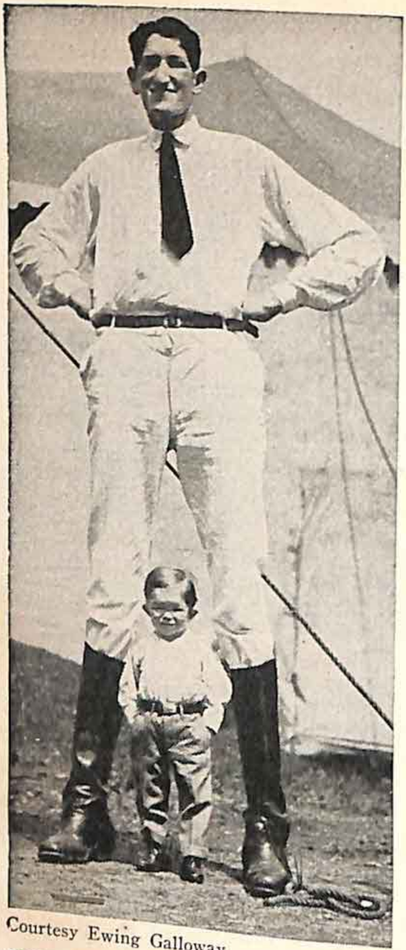
SUPREME EFFORT put forth by athletes is made possible by the secretions of the adrenal (sometimes called suprarenal) glands.

If there seems to be a tendency to have goiter in the family, a physician should be consulted before iodine is added to the food. Iodine taken internally may in some persons cause a breaking out of the skin.

Sometimes children are born with very limited thyroid development. Such children are known as *cretins*. The body is stunted and the features are coarse. The child is greatly retarded mentally and physically. If the child can be fed thyroid secretion early in the disease, he may develop normally. After persons are grown up, if the thyroid gland is destroyed by disease or accident, a similar condition, known as *myxedema,* develops.

Extract of thyroid gland is a powerful and dangerous drug and should never be used except under the direction of a physician. Certain obesity "cures" contain thyroid extract.

Energy for emergencies. One of the quickest acting and most powerful of the hormones is secreted by the *adrenal glands*. There are two adrenal glands, lying just above the kidneys. When their secretion is poured into the blood stream, glycogen in the liver is released as sugar for quick use by the muscles. This accelerates heart action and raises blood pressure.



Courtesy Ewing Galloway

THIS "GIANT" is eight feet, seven inches tall. His small companion is only 23 inches high, although he is fully grown. How can you account for the difference in size of these two individuals?

These glands respond sharply to emotional excitement. Anger or fear causes large amounts of the secretion to be poured into the blood stream. This stimulates the voluntary muscles, giving them greater power, speed, strength, and endurance. As a result, in sudden emergencies men sometimes exhibit almost superhuman strength.

The pituitary gland. The pituitary gland is a small organ, a little larger than a pea, located at the base of the brain between the ears. It consists of three parts. From the upper front part is secreted a hormone which regulates the growth of the skeleton and the size of the body. Giants and dwarfs, such as we sometimes see at circuses, owe their unusual stature to excessive or insufficient activity, respectively, of this tiny gland. The pituitary gland also influences many other activities in the body, such as stimulating the thyroid and adrenal glands.

The pancreas. The pancreas, a gland located below and behind the stomach, has a duct but may also be considered as a ductless gland. Its external secretion, the pancreatic juice, is poured into the intestine to aid digestion. Its internal secretion, absorbed into the blood stream, enables the liver to store sugar and regulates the oxidation of sugar in the muscles. When a person lacks this hormone, he cannot store sugar in the liver or oxidize it when energy is needed. The sugar then accumulates in the blood or is thrown off by the kidneys. This condition is the disease called *diabetes*. Dr. (now Sir) Frederick Banting of Canada isolated the hormone from the pancreas of other animals and, as insulin, made it available for treatment of diabetes in man. Since the digestive juices destroy insulin, it cannot be taken with food or swallowed as medicine but must be injected beneath the skin of the person afflicted with diabetes. If begun in time, this treatment, with careful planning of the diet, restores and maintains health. But it is not a cure in the sense that after a time it may be discontinued.

Gland extracts. There are other endocrine glands which give off hormones, but their functions are not so clearly established. The many false and ridiculous statements and claims made by those who have only a half knowledge of the endocrine glands should be regarded with caution. Patent medicines containing gland extract should be avoided.

Rest for nerve cells. Since the nerve cells are continuously in action during the waking hours, plenty of rest is necessary for them. Working under improper conditions also produces nerve strain. Recreation and change of work tend to rest the nerve cells.

The only complete rest for both body and mind, however, is sound sleep. People have been known to fast for days without serious injury, but loss of sleep for even thirty-six to forty-eight hours has given rise to serious mental and physical symptoms. The amount of sleep needed is to some extent in proportion to the energy used (see p. 278). A high school pupil often uses up a great deal more energy than his parents who require about eight hours of sleep.

Daily living. Proper diet, fresh air, sunshine, sleep, rest, elimination of wastes, and avoidance of alcohol, tobacco, and drugs are very important in maintaining a healthy nervous system. Upon these depend successful adjustment to daily living.

Too rapid consumption of energy. The trend of the times is for persons to keep constantly busy during the day, using a great deal of energy, and then to stay up late at night. This makes it impossible wholly to recuperate from fatigue or to build up

6. Collect labels and advertising material of different iodized foods. Consult a physician as to the truth of the claims made for the advertised product.

Test

Directions: There are six incomplete statements in this test (A, B, C, D, E, and F), each followed by a varying number of parts. One or more of these parts, or perhaps none of them, correctly completes the incomplete statement. On a separate sheet of paper copy the six letters and the numbers of their parts in a vertical column. Place a plus sign (+) after the number of each part that correctly completes the statement. Do not write in the book.

A. The nervous system is very important to the human body because it
   1. supplies oxygen.
   2. regulates the vital processes.
   3. controls intelligent action through the cerebrum.
   4. is located in all parts of the body.
   5. co-ordinates muscular action.

B. The nervous system is kept in good health by
   1. the use of stimulants.
   2. regular periods of rest and relaxation.
   3. proper amount of nourishing food, fresh air, and sunshine.
   4. the development of good habits.
   5. carrying on many types of amusements.

C. The spinal cord
   1. conveys impulses between the brain and most parts of the body.
   2. controls reflex action.
   3. is protected by the spinal column.
   4. is gray in color.
   5. governs the emotions.

D. A new skill is more easily learned by
   1. many repetitions of the same act.
   2. rapid performances of the act.
   3. having all the connections to the nervous system closed.
   4. being interested in acquiring the skill.

E. Mealtime should be a happy time
   1. because emotional disturbances interfere with digestion.

resistance against fatigue. Because of this too rapid consumption of energy, one should cultivate the ability to relax. Noise also is another element that greatly increases nervous fatigue. Of all the dangers arising from fatigue, the effect of noise upon the nervous system is the most serious. Anything which injures the nervous system is very dangerous to the welfare of the individual. Like alcohol and narcotics, fatigue decreases general efficiency. Then too, people who are chronically tired do not enjoy living with themselves or with others.

In conclusion

BODILY states—hunger, discomfort, fatigue—often determine mental and emotional reactions. An emotional upset—anger, fear, hatred—may give rise to gastric, circulatory, and nervous disturbances. Therefore the health of the individual depends upon maintaining a proper balance between the central nervous system which controls voluntary actions and the autonomic system which controls involuntary activities. There must be a certain co-ordination and harmony of action between the two systems. Furthermore, the health and happiness of the individual are intimately bound up with the kind of mental habits and attitudes he develops and maintains.

Activities

1. Ask to see a calf's brain at the meat market. You may be able to locate the cerebrum, the cerebellum, the spinal bulb, and the upper end of the spinal cord. Note the deep grooves (convolutions) on the outside of the cerebrum.

2. Make a list of at least twenty different actions performed by you in one day. Next to each, write whether it is a reflex, a habit, or a conscious act. Name acts that are still conscious but should be habitual.

3. Analyze the mental and physical skills necessary for the occupation in which you are interested. How may they be trained?

4. List the things you do which involve a needless expenditure of energy.

5. Consider the need of a vacation by a member of your family or by an acquaintance.

   2. because body processes are accelerated by conditions that are cheerful.
   3. because one can eat more food.

F. Hormones are important to the body because they
   1. circulate in the blood.
   2. control certain body processes.
   3. are produced by the ductless glands.
   4. are powerful chemical substances.

Associated subjects

Biology: A healthy body depends upon the normal functioning of the nervous system and the ductless glands.

Physical education: The value of exercise and rest in maintaining a healthy body.

Psychology: How the nervous system, the sense-organs, the muscles, and the glands work together. . . . The formation of habits. . . . How we learn. . . . The origin and development of our feelings. . . . The organization of a sound personality.

References

Carlson and Johnson. *The Machinery of the Body.*
Clemensen and LaPorte. *Your Health and Safety.*
Howard. *Your Health and Personality.*
Rhoades. *The Self You Have to Live With.*
Sorenson and Malm. *Psychology for Living.*
Wheat and Fitzpatrick. *Health and Body Building.*
Williams. *Healthful Living.*
Wilson, Bracken, and Almack. *Life and Health.*

Films

Endocrine Glands. 15 minutes, sound. Encyclopaedia Britannica.
The Nervous System. 12 minutes, sound. Encyclopaedia Britannica.

20. *WE CAN GROW OLD AND BE WELL*

YOUTH is the period of hope and enthusiasm. Cares are felt lightly; energy seems boundless. Age is thought of as far away. However, it may be worth while to take stock of oneself now, and then project oneself into the future.

How are you going to look ten years after graduation? Will your body begin to show signs of wearing out too soon? How are you going to feel twenty or thirty years from now? Will you be living comfortably and successfully without physical and emotional handicaps? What are you doing now in the years before twenty to help you meet the hazards that will exist after forty?

Do you know . . .

1. *How modern living makes it difficult to keep the body machine in good repair?*
2. *What degenerative diseases are?*
3. *How the leading causes of death have shifted in the past thirty years?*
4. *How heart diseases of youth and middle age may be prevented?*
5. *How vigorous exercise affects the heart?*
6. *What are the causes of valvular heart disease?*
7. *What causes tissues to wear out too soon?*
8. *Why hardening of the arteries is associated with old age?*
9. *In what ways the heart may be impaired?*
10. *What cerebral hemorrhage or apoplexy is?*
11. *How much is known concerning the nature, treatment, and cure of cancer?*
12. *Why periodic health examinations are desirable?*
13. *What diseases are associated with middle age and later life?*
14. *How arteries lose their elasticity?*
15. *How valvular heart disease may develop in young persons?*
16. *Why athletes should have frequent physical examinations?*
17. *What is meant by cerebral hemorrhage?*
18. *Why the cancer quack is especially dangerous?*

Courtesy Johnson and Johnson

NEW-BORN infants today have greater chances of living longer than ever before. During the last generation twenty years have been added to the average life expectancy. This has been accomplished by better care at birth and during infancy. More knowledge about nutrition, control of communicable diseases, and new drugs has helped more people to reach adulthood. Diseases of old age are a major health problem today.

Leading Causes of Death in the United States [1]

CAUSES	RANK IN 1900	ANNUAL DEATH RATE (PER 100,000) IN 1900	RANK IN 1950	ANNUAL DEATH RATE (PER 100,000) IN 1950
Tuberculosis	1	195	6	22
Pneumonia	2	176	5	31
Diarrhea and enteritis	3	140	Not in first ten	
Diseases of the heart	4	137	1	354
Nephritis (Bright's disease)	5	89	7	19
Congenital malformations and diseases of early infancy	6	88	9	12
Cerebral hemorrhage	7	77	3	103
Measles, scarlet fever, whooping cough, and diphtheria	8	76	Not in first ten	
Accidents	9	72	4	60
Cancer	10	64	2	140
Diabetes mellitus	Not in first ten		8	16
Suicides	Not in first ten		10	11
TOTAL		1,114		768

A new problem. During the past forty years the infectious diseases of infancy and childhood have been greatly reduced and in some cases almost eliminated (see chap. 25). So the average age of our population has been increasing, and many more persons live to be old. But those who have escaped the diseases of childhood are confronted with new hazards. Heart disease, cancer, nephritis (Bright's disease), and cerebral hemorrhage are the diseases especially associated with middle age and later life.

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[1] From Federal Security Agency, Public Health Service, and National Office of Vital Statistics.

Courtesy Mutual Benefit Life Insurance Company

HURRY AND PRESSURE of responsibilities cause nervous tension in the businessman, producing diseases of the heart and blood vessels. His family can help by being dependable and understanding.

These become, then, leading causes of death. How to meet these dangers, which are becoming more serious each year, is a major health problem of today. It is interesting to note in the table on page 304 that in 1946 the total death rate per 100,000 from the first ten causes was much less than it had been in 1900.

Heart disease. A few years ago heart disease reached first place as a cause of death for people of all ages and, in spite of better diagnosis and treatment, it is still on the increase. Heart disease may be either valvular (see p. 222) or degenerative. Valvular heart disease usually develops in young persons. Infections resulting from measles, scarlet fever, influenza, or tonsillitis may damage the valves. Tonsillitis and sore throat may bring on rheumatic fever, sometimes called "growing pains," which injures the heart muscles or valves. Many of these diseases can be prevented. When they do occur, expert care during convalescence is important. All infections are likely to injure the heart muscle, so prolonged rest after infection is a safeguard against heart injury.

Courtesy Ewing Galloway

THE BRIGHT LIGHTS of the city help to carry activities far into the night. Those who persistently keep late hours get insufficient sleep. Using up too much energy in any form of excitement will, in the long run, impair health.

Other types of heart disease are due to degenerative processes, severe general diseases, such as syphilis, and various other causes. Alcohol and tobacco used in excess injure the heart, as well as other organs, seriously. Tea and coffee in large quantities may also be injurious.

Exercise and the heart. Physical exercise, taken under proper conditions, strengthens the heart for sending sufficient blood to the brain and muscles. Athletes, however, should have frequent physical examinations to detect any weakness, for a defective heart is often injured for life by excessive training and too great exertion. If the heart shows any signs of being overworked, training should be modified. Most persons do not exercise enough to keep the heart in the very best condition. If one has a weak or diseased heart, he should exercise only according to the physician's instructions.

Courtesy Ewing Galloway

THE ELEVATED TRAIN is only one of the many sources of noise in our large cities. The constant din from all sides is a drain on the nervous energy.

Hardening of the arteries (arteriosclerosis). In youth, the arteries are elastic and respond to the pressure of the pulse and to the stretching brought about by changes in the circulation (see p. 218). As a person grows older, this elasticity is gradually lost because of replacement of the elastic and muscle tissue by lime salts and rigid fibrous tissue. The walls of the vessels become thicker, more rigid, and at times brittle. This is, in the main, a natural process and may not give rise to any symptoms. If, however, the change is rapid, if it occurs at an unusually early age, or if the arteries of some vital organ are seriously affected, symptoms of disease appear. Not all arteries in the body change at the same time or at the same rate. In some individuals, the vessels of the arms and legs are involved; in others, the vessels of the brain, of the kidneys, or of the heart itself are affected. Hardening or degeneration of the arteries is not always accompanied by high blood pressure. The channel through which the blood flows may become very much narrowed or may close completely. If stretching of the arterial wall occurs, the artery may break.

Hardening of the arteries is, on the one hand, a symptom of the aging process; and, on the other hand, it is a factor in accelerating that process. In some individuals it comes in the prime of life; while in others very old age may be reached with relatively little change in the arteries. There is a good deal of truth in the saying, "A man is as old as his arteries."

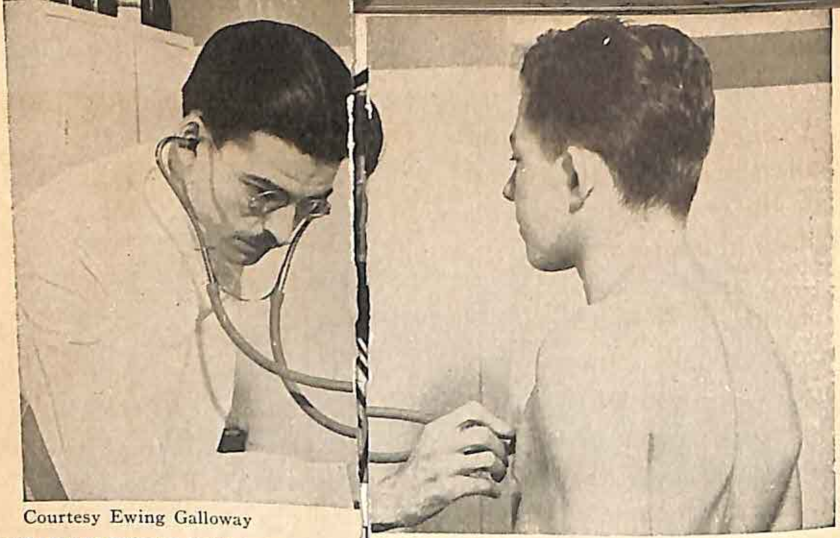
Disturbances in circulation. The heart must keep the blood flowing steadily through the body, or life ceases. As the elasticity of the wall diminishes and as the size of the opening in the artery is reduced, the flow of blood can only be kept up under greater pressure from behind. The heart, which pumps the blood, exerts a greater effort against this resistance in the arteries, and the effect is known as increased blood pressure. Continued overexertion of the heart finally reduces the reserve power so that the heart may fail gradually, or suddenly under special strain. Many cases of breakdown of the heart are due to rupture or blocking of a blood vessel in the wall of the heart itself (see p. 222).

In the early stages, high blood pressure is not always accompanied by important organic changes; and in such cases change of habits, especially as to work, rest, and diet, may lead to striking improvement. Unfortunately, no effective treatment has been found for the increased blood pressure which is due to advanced arterial disease, although the patient's condition may often be rendered more comfortable by drugs or medical treatment.

Cerebral hemorrhage. If weakened, brittle arteries of the brain break, a bleeding or hemorrhage occurs in the surrounding tissue. This is known as *apoplexy*. The paralysis which usually follows a stroke of apoplexy is due to destruction of, or pressure of blood upon, the brain cells.

Diabetes and Bright's disease. As the arteries become narrower, not enough blood can pass through them and the very small arteries (arterioles), or even larger vessels, may be completely closed. Any organ nourished by an artery thus affected gets an insufficient supply of blood. If these changes take place in the pancreas (see p. 191) of a middle-aged person, diabetes may develop. This is distinct from the diabetes which may develop earlier in life because insulin is not formed normally (see p. 299). If the vessels of the kidneys become hardened, chronic Bright's disease may follow.

Degenerative diseases. The diseases already considered in this chapter may be regarded as degenerative diseases. Heart disease,



Courtesy Ewing Galloway

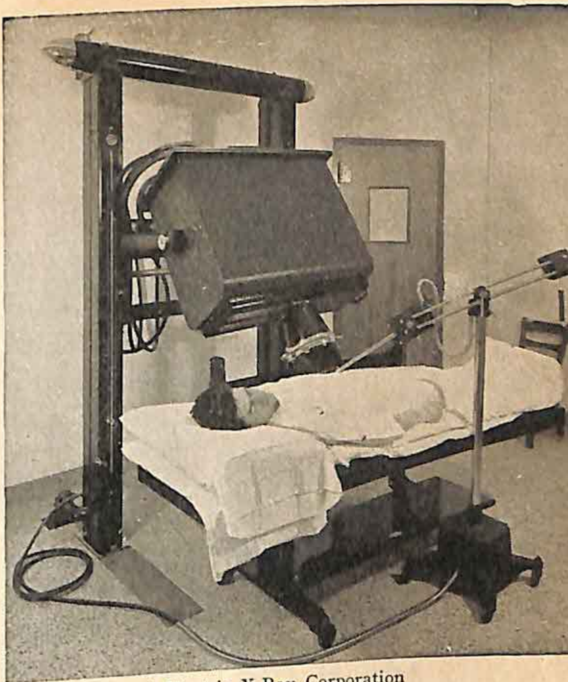
MANY YOUNG MEN and women are given thorough physical examinations in connection with their entrance into college, industry, and business. Part of this examination is testing the lungs and heart with a stethoscope.

hardening of the arteries, and Bright's disease are diseases which develop slowly and result from a gradual breakdown or degeneration of the tissues and organs of circulation. Sometimes the body is weak in the first place because of poor heredity. It has been said that the best assurance of reaching old age comfortably is to have chosen one's ancestors wisely.

However, the tendency toward such disorders may be aggravated by an excess of food or an inadequate diet, by insufficient physical exercise or overwork, by alcoholism, by excessive use of tobacco, and by chronic systemic infections. The body is continually subjected to nervous and mental shocks, to poisons manufactured by disturbed organs, and to poisons contained in food and air. The strain placed upon the body is increased by the greater speed and intensity of modern living.

Precautions. A proper balance between rest and exercise is important in protecting the heart. If a defect of the heart is discovered early, change in occupation and in the habits of living may be sufficient to postpone serious consequences for a long time (see p. 227).

The most frequent ailments from which we suffer are tooth infections, colds, bronchitis, influenza, tonsillitis, and other acute infections of the upper respiratory tract. Means of avoiding these infections are discussed in a later chapter (see p. 385.)

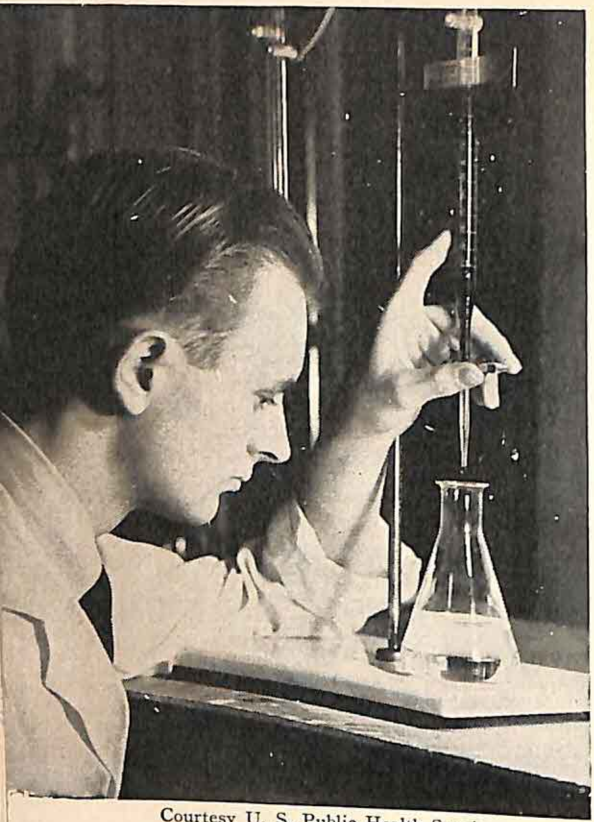


Courtesy General Electric X-Ray Corporation

THE X-RAY machine is a means of detecting disease and, as shown here, is also used in the treatment of certain diseases.

Early detection of any weakened condition is of prime importance. An annual medical examination for both children and adults is one means recommended. It seems only reasonable that persons should pay at least as much attention to their bodies as they do to their automobiles. If any abnormal condition appears, a thorough physical examination should be sought at once. By this means, important conditions may be discovered before it is too late to remedy them. If such conditions are disclosed, expert opinion for their treatment should be accepted. But morbid brooding over real or supposed ailments may be as destructive as the actual ailments themselves.

Cancer. This is the most dreaded disease of middle and old age. It is second among the leading causes of death. The cause of cancer is not yet understood. Most cancers are probably not degenerative changes associated with the process of aging, although some forms are particularly apt to occur later in life. Some persons still retain the impression that cancer can never be cured. Research is being carried on continuously, and everything points to the conclusion that the cause of cancer will some day be discovered. It is already a less hopeless disease than it was a few years ago. At the present time, cancer is curable in most instances, provided the right kind of treatment is given early.



Courtesy U. S. Public Health Service

THIS TECHNICIAN is matching an acid with a base. The process, called titration, is one of the techniques used in the war on cancer.

Unlimited growth of cells in cancer. The body is composed of billions of cells, just as a wall is made up of many units or bricks. There are many kinds of cells. They differ in size and shape, but they are all so small that they cannot be seen unless greatly magnified. Under ordinary conditions the cells constitute a harmonious whole, no cell interfering with another and no group of cells growing out of proportion to any other group of cells.

Sometimes, however, and for no known reason, some of these minute cells begin to grow wildly or without control, multiplying much faster than normally. They spread in every direction and destroy the other cells that may be in the way. Their growth never stops. Often in a relatively short time these cells develop into a large mass, although there are some very slow-growing masses. This unlimited growth of the cells is known as *cancer*. From some types of cancer, cells pass into the blood and are carried to distant parts of the body, where they repeat the same process of growth and destruction. A cancer may be on the outside and visible, or it may be hidden inside of the body.

Cause of cancer. As far as present knowledge goes, cancer is not a germ disease, so it cannot be carried from one person to another. There is no scientific proof that cancer, in man, is inherited, although recent investigations indicate that it is probable that one type of cancer in mice is inherited. The unusual prevalence of the disease in certain human families suggests that susceptibility (failure of cells to react protectively) may be inherited. Certain types of cancer are believed to be due to chronic irritation.

Some people believe it is a disgrace to have cancer in their families. Such a foolish notion may keep them from seeking medical treatment.

Treatment and prevention of cancer. There are only three reliable methods of treatment for cancer: by surgical operation, with radium, and with X rays. These methods vary in suitability for different cases. Sometimes more than one method may be used effectively. The best method can be determined only by an experienced physician. The sooner proper treatment is given for cancer, the better the outlook.

Courtesy U. S. Public Health Service

HERE WATER is being double distilled in order to remove all impurities. The presence of any foreign substance in any research experiment can greatly alter the results and so lead to incorrect conclusions. In research on cancer, every effort is made to maintain the purity of all materials used.

The doctor cannot do his part if the patient does not consult him in time. The presence of a lump, persistent bleeding, a sore that does not heal readily, internal pain, or loss of weight otherwise unexplained may be a sign of cancer and should call for careful examination.

Some say that such continued emphasis on cancer will create a cancer scare. That is in no sense necessary. But even if that

Courtesy U. S. Public Health Service

TISSUE that may show the presence of cancer is prepared for study in a sterile room.

should be the case, is it not better to be afraid of cancer than to have an incurable cancer? If examination actually reveals cancer, then the patient has a chance of being cured. If examination fails to reveal evidence of cancer, the patient's mind should be relieved of anxiety.

Fake cures for cancer. There are many alleged cancer cures. In spite of unscrupulous statements to the contrary, it must be remembered that no medicine, diet, or serum exists that will cure cancer. Ointments and plasters are dangerous. Massage and manipulation tend to scatter the cancer cells throughout the body. The cancer quack is a very dangerous person. He may be able to remove the cancer at one point, but it spreads to other places in the body. In the meantime, the cancer progresses, until even the best medical care is unavailing.

In conclusion

MAN cannot live forever, nor can he always enjoy perfect health; but every normal person should have his full share of life and health. The best plan is to maintain health and vitality by intelligent living and to secure prompt medical care when needed, so that the degenerative processes of advancing age may be retarded as much as possible. A slowing down of one's activities in middle adult life is called for in a world that is increasing the tempo of living.

Activities

1. Consider why people sometimes shrink from having a medical examination or are ashamed to admit illness.
2. List activities indulged in by members of your family which might eventually harm their hearts.
3. List elements in modern life that create nervous diseases.

Courtesy U. S. Public Health Service

THERE ARE three reliable methods for the treatment of cancer.

4. List the advantages and disadvantages of either city or country as far as effects upon healthy living are concerned.

Test

Directions: On a separate sheet of paper write the letters from A to H, corresponding to the letters of the definitions that follow. After each letter place the number of the term which best fits that definition.

A. The leading cause of death today.
B. A symptom of the aging process.
C. Bleeding from a blood vessel in the brain.
D. A safeguard against injury to the heart after an illness.
E. A method of checking up on disease in the body.
F. A disease manifested by an unlimited growth of cells.
G. An effective method of treatment of cancer.
H. A disease associated with the kidneys.

1. medical examination
2. tuberculosis
3. prolonged rest
4. cancer
5. heart disease
6. Bright's disease
7. hardening of the arteries
8. cerebral hemorrhage
9. X ray
10. valvular
11. medicine
12. ointment

Associated subjects

Biology: The nature of cells and the dependence of the vital organs—brain, heart, kidneys—upon adequate circulation of the blood. . . The need for proper exercise and diet, as well as periods of relaxation and rest after work, as safeguards against too early breakdown of the body machine. . . . The dangers (in the aging process) from poisons.

Physical education: Periodic physical examination. . . . The assistance given pupils in adjusting exercise to individual needs.

References

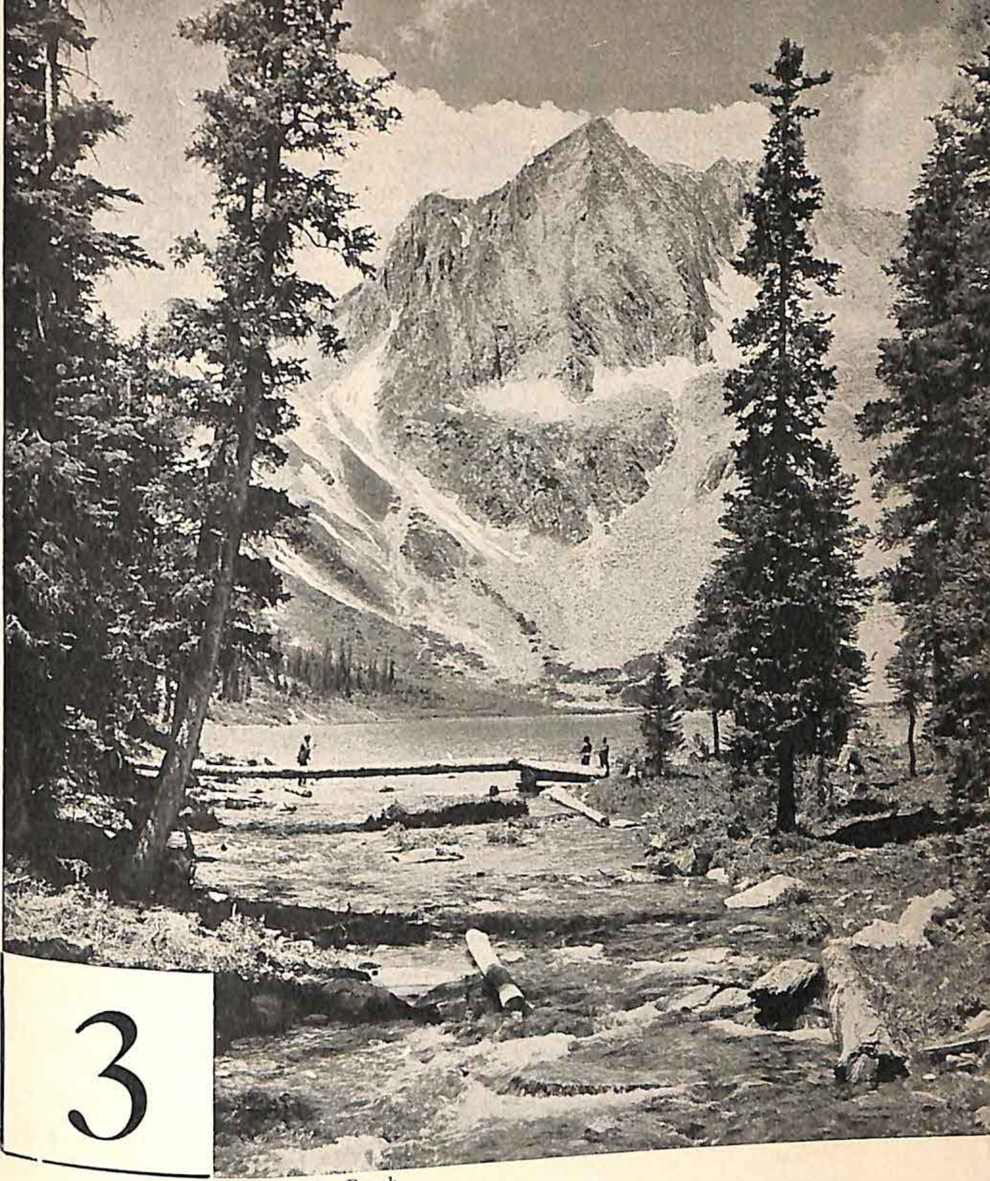
Carlson and Johnson. *The Machinery of the Body.*
Clemensen and LaPorte. *Your Health and Safety.*
Meredith. *Health and Fitness.*
Notes of Hope and other publications of the American Cancer Society
Wilson, Bracken, and Almack. *Life and Health.*

Films

Traitor Within (cancer). 10 minutes, sound, color. American Cancer Society.

You, Time, and Cancer. 16 minutes, sound, color. American Cancer Society.

Be Your Age (heart). 11 minutes, sound. Metropolitan.



3

Photo by O. Roach

Your Health and Personality

21. WE INHERIT SOME TRAITS BUT WE ACQUIRE OTHERS

HOW does it happen that you are similar and yet different in appearance and behavior from your father or mother, your brother or sister? Why are your tastes and opinions often different from those of your friends? How do your chances for being a healthy person compare with those of others? An explanation of these questions may be found in a consideration of the influences that have directed your development. These include the traits which you have inherited from your ancestors, the environment or surroundings in which you have lived, and your training, or the way in which you have responded to your heredity and environment.

Do you know . . .

1. What is the beginning of each individual?
2. What heredity is?
3. Why not all individuals develop in the same way?
4. How heredity and environment affect the development of an individual?
5. What characteristics are inherited?
6. What the determiners of heredity are?
7. If it is possible for an individual with a weak constitution to avoid disease?
8. What traits are not inherited?
9. What human defects are inherited?
10. How unfavorable surroundings can destroy a favorable inheritance?
11. How favorable surroundings can improve upon a poor inheritance?
12. Why no two individuals are exactly alike?
13. How many chromosomes are present in the human body cell?
14. What is the difference between genes and chromosomes?
15. What is a dominant trait?
16. What is a recessive trait?
17. What determines the behavior of an individual?
18. What is eugenics?

Likenesses and differences. All individuals of a kind are much alike. One can easily recognize maple trees because all maple trees resemble one another. Elephants resemble all other elephants, yet no two of them are exactly alike. We may know and call by different names the many pupils in our school, because each pupil differs in many ways from all the others.

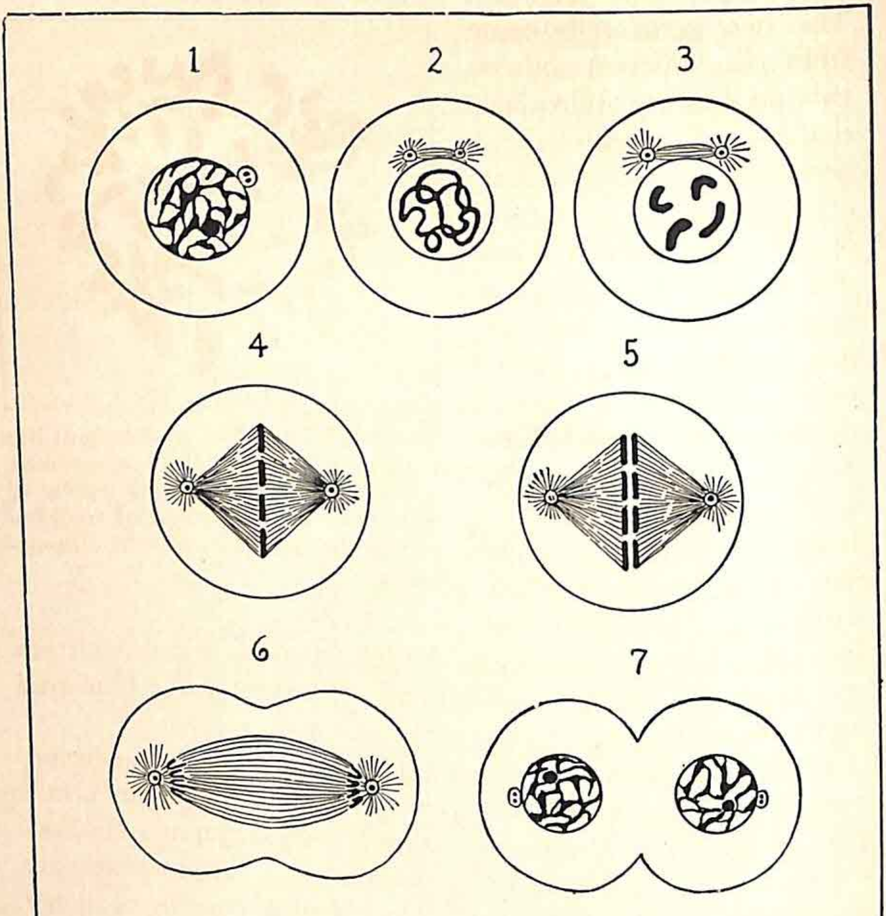
Individuals of the same kind may differ because all do not have the same outward conditions or environment during their early development. Temperature, moisture, light, and food are some of the factors that influence the development of animals as well as plants. Inequalities of environment may bring about differences among individual human beings. In a previous chapter it has been pointed out that lack of vitamin D in the diet results in bone deformities, that lack of iodine may give rise to cretinism, that too much food is likely to make people fat.

These differences, due to environment, affect only the body cells of the organism and are called body variations. They modify the individual without affecting to any great extent the offspring of the individual.

Ancestry influences development. In addition to the conditions in the environment, there is something with which the individual is born that influences his development and makes him different from others who live in the same surroundings. The characters or variations that are inherent in the individual are a part of the ancestry, and these qualities can be transmitted from parent to offspring because they are a part of the germ plasm or germ-cell substance.

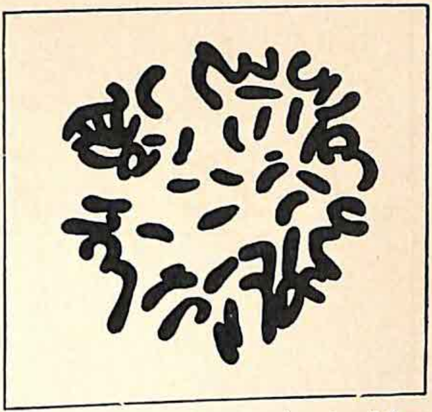
The transmission of certain characteristics of the parents to the offspring is known as *heredity*. Curly hair, tall stature, and fair skin are transmitted to the children at birth and cannot be changed by environment. Physical traits are definitely passed from one generation to another. Sometimes these traits may skip one or two generations and reappear. Brown-eyed children have at least one brown-eyed parent or grandparent.

Development. Every living thing comes from a single cell. Each human being begins as a cell or fertilized egg, formed by the union of two separate germ cells—the sperm cell and the egg cell.



THIS DIAGRAM of cell division shows the behavior of chromosomes. A new plant or animal comes into existence as a fertilized egg. Growth consists in increasing the number of cells. Each cell divides to make two. The nucleus of an ordinary resting cell (1) contains a network of granular fibers known as chromatin. In the figures that follow, note the changes in the chromatin of the nucleus: In 2 the network of chromatin fibers forms a thread; in 3 the chromatin thread breaks up into a definite number of rod-shaped bodies called chromosomes; in 4 a spindle of fine threads has formed, and the chromosomes are arranged along the equator of the spindle; 5 shows how each chromosome splits lengthwise; in 6 the chromosome halves move apart toward the poles of the spindle, and the cell body begins to divide; in 7 the division of the cell body is complete.

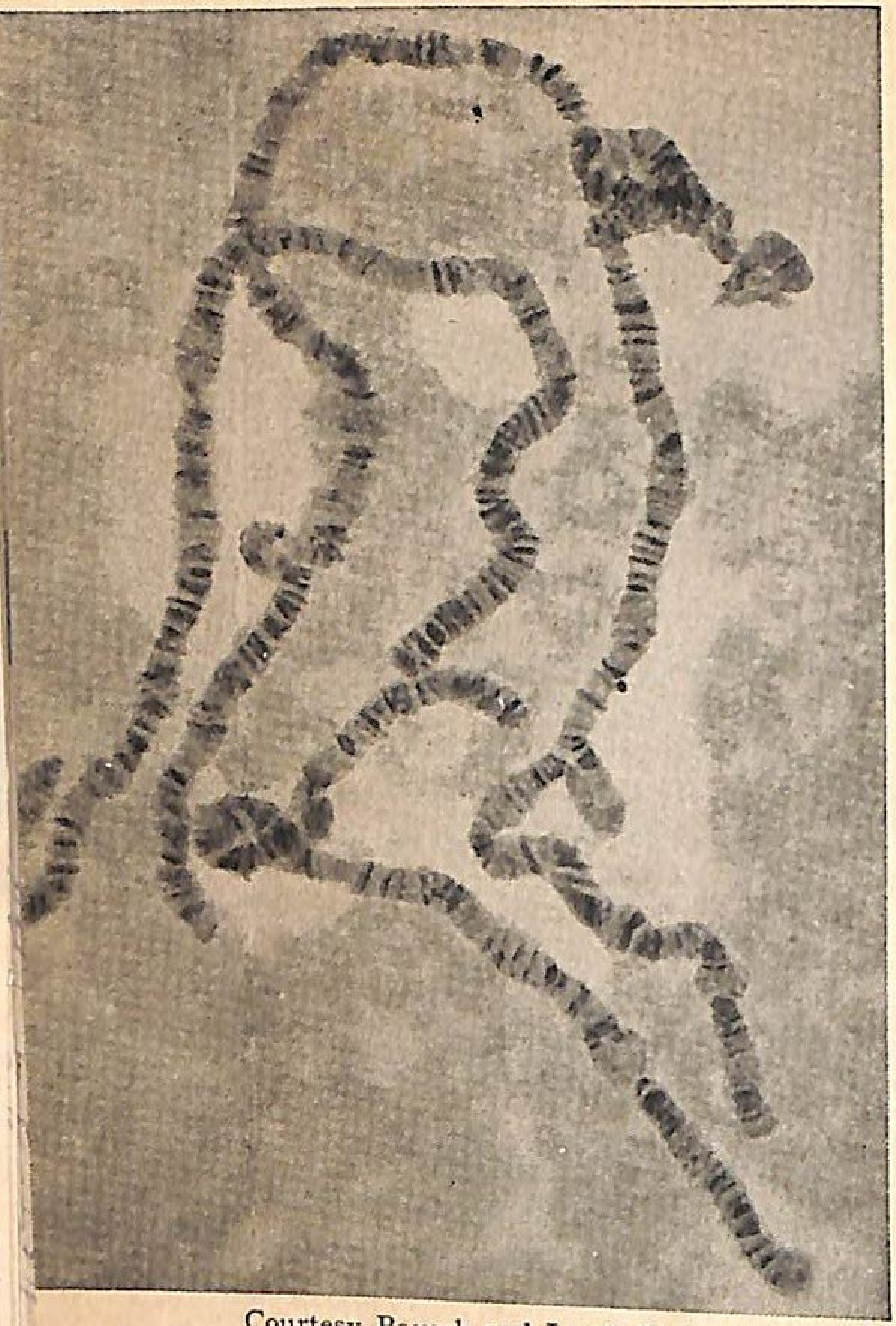
The two germ cells come from two different sources, two pre-existing individuals that we call parents. Each germ cell carries many characteristics of the protoplasm of the parent from which it was derived. These qualities reappear with a certain degree of probability and in relationship to each other as the individual develops. Thus each individual resembles both parents, but also differs from both parents. A child may have brown eyes like the mother's and curly hair like the father's. Offspring of the same parents also differ from one another. Some may be tall and some short, some blue-eyed and some brown-eyed.



EACH KIND of plant and animal has a definite number of chromosomes, or strings of genes, characteristic of that kind. In the nucleus of each human body cell there are 48 chromosomes.

Within the fertilized egg or cell, which is the first developmental stage of a human being, is a nucleus, the most important part of the cell. The nucleus contains special bodies, chromosomes, that are visible under the microscope. Chromosomes are not simple structures, but each chromosome consists of many parts, and it is thought that each part is responsible for certain hereditary characteristics. These parts are called *genes*.

Determiners. Each single character, such as color of hair, is called a *unit character,* because it is transmitted independently of all other characters. There are two genes or determiners in the body cells for each unit character. In each egg or sperm cell there is but one gene for each unit character. When egg and sperm unite to form a new organism, the gene for the unit character in the one associates with the gene for the corresponding unit character in the other to provide the two genes of the unit character in the body cells of the new organism. Thus each individual is double with respect to his genes.



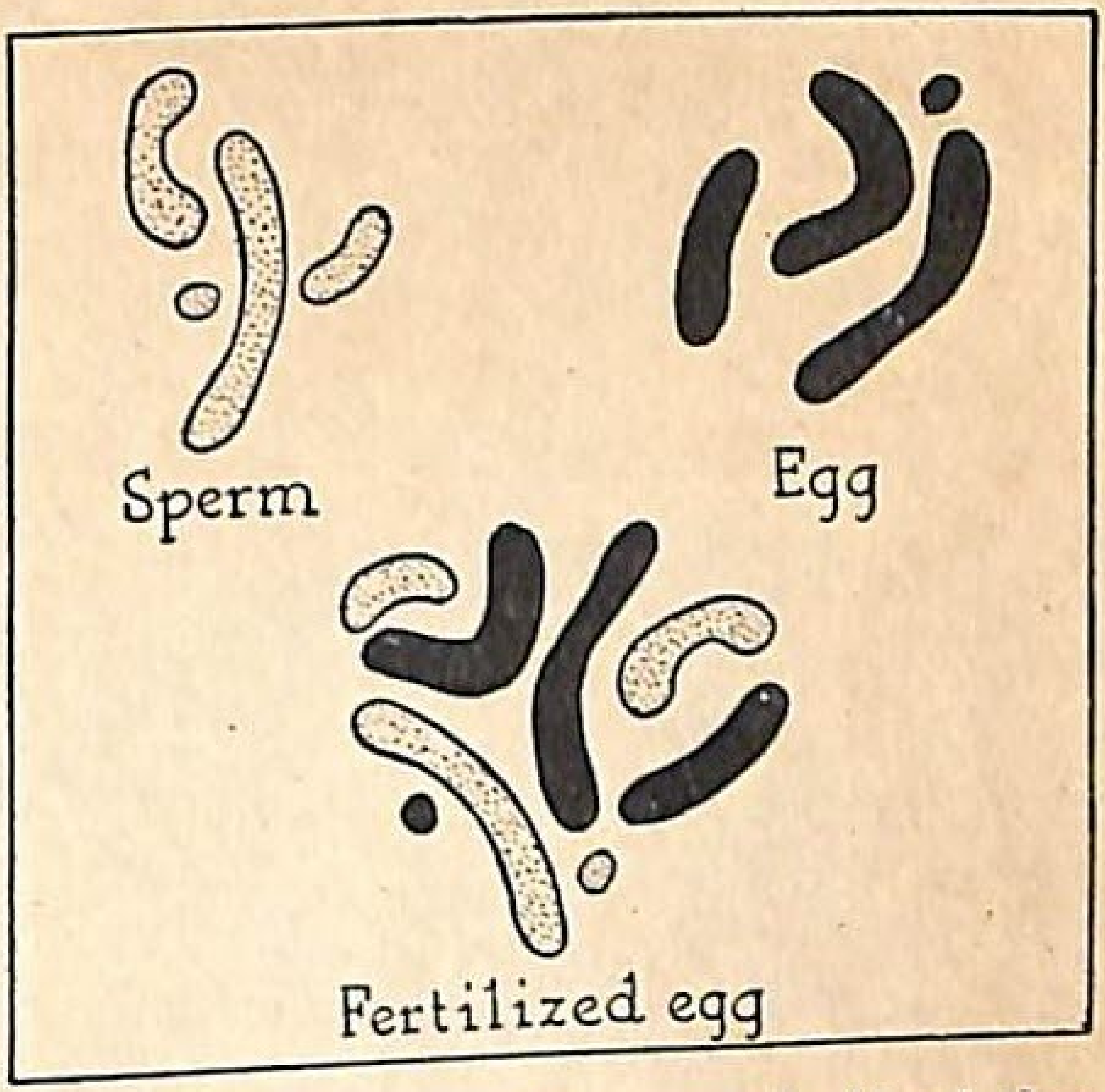
Courtesy Bausch and Lomb Optical Company

CHROMOSOMES in cells from the salivary gland of the fruit fly are enlarged 1,000 times in this photomicrograph. The dark patterns are believed to be genes.

Dominant and recessive traits. When one character carried by a gene is stronger than the corresponding character carried by the other gene of the same pair, the strong one is called *dominant* and the one that is for *the time being hidden* is called *recessive.* Brown or black color in eyes hides blue; so brown or black eyes are said to be dominant and blue eyes are said to be recessive. However, if a brown-eyed man marries a brown-eyed woman, some of the children may be blue-eyed. If this is the case, it is evident that each of the parents possesses the recessive trait of blue eyes.

How characters are transmitted. In the limited space of this book it is impossible to give a complete account of how characters are transmitted through inheritance. The transmission of human qualities occurs according to the same principles that govern inheritance in plants and lower animals. How dominant and recessive traits appear in offspring may be illustrated in the case of inheritance in black and white guinea pigs. Black is dominant over white. If a black guinea pig is crossed with a white guinea pig, the offspring or children of the first generation (F_1) will all be black. These offspring are hybrids, since they possess both black and white qualities, but they show only black because it is dominant.

If the hybrids are crossed, then in the second generation (F_2), or that of the grandchildren, the characters separate in the following ratio: one black (pure); two black (hybrids); one white (pure).

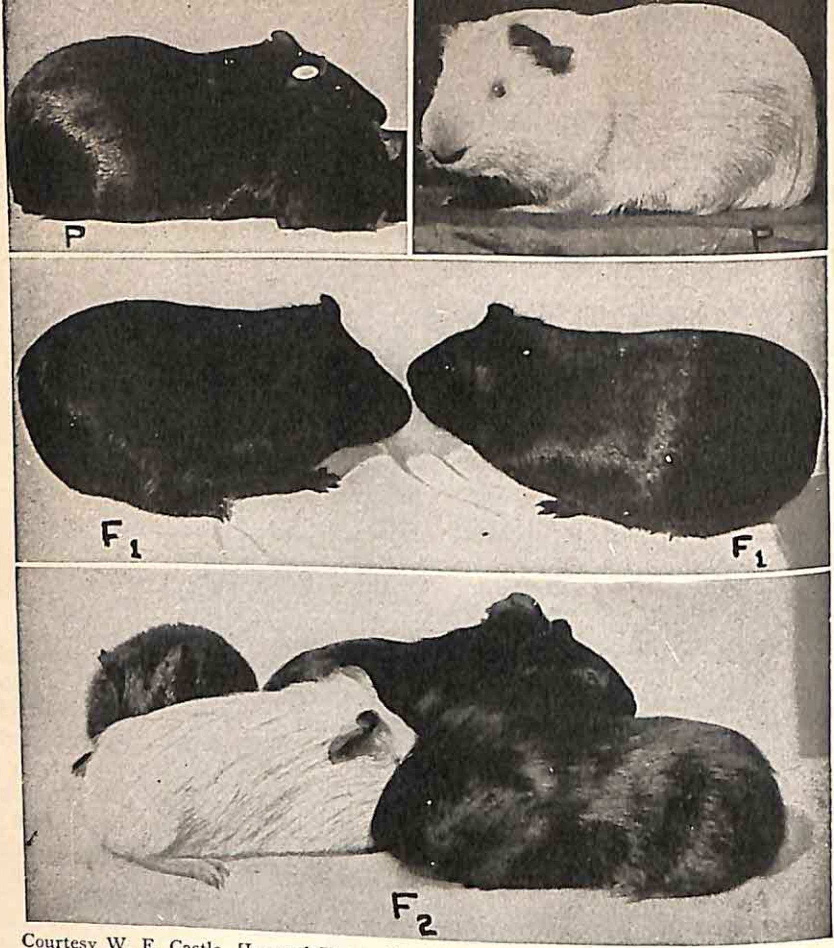


IN REPRODUCTION, one half of the chromosomes of the male germ cell, or the sperm, unite with one half of the chromosomes of the female germ cell, or the egg cell. Thus the fertilized egg has a full set of chromosomes—one half supplied by the mother and one half by the father.

The pure black guinea pig, if mated to another pure black, will always thereafter breed true, that is, it will produce only blacks. In the same way, the pure white, if mated to another pure white, will produce only whites. But the hybrids—which look like the pure black, but are half black and half white—if mated with a hybrid, will produce offspring that will always separate into three kinds: one pure black; two hybrids; one pure white.

In the crossing of two hybrids, if a character is dominant, it appears in every generation, but if a character is recessive, it may appear only in every alternate generation. Both dominant and recessive traits are inherited as unit characters and the gene for the character is either present or absent.

Inherited traits. There is a fairly definite agreement that certain physical traits are hereditary, such as the color of the skin, hair, and eyes; the size and the proportion of the parts of the skeleton; the waviness and abundance of hair; and the activity of the glands. Certain physical defects are also inherited, including some types of blindness, certain kinds of deafness, color-blindness, hemophilia (uncontrollable bleeding from simple wounds), and glandular defects. Strong constitution, longevity, and predisposition to certain diseases are believed to be inherited. It is thought by many authorities that there may be an inherited lack of resistance to certain diseases, including tuberculosis and cancer. But



Courtesy W. E. Castle, Harvard University

COLOR INHERITANCE in guinea pigs bears out the three-to-one ratio in the offspring of two hybrid parents (F_1). White color, a recessive character, appears in every alternate generation.

the individual whose genes produce a body that is susceptible to tuberculosis would not need to have the disease if he could take measures to prevent the germ from entering and developing in his body.

Not much is known about the inheritance of mental traits. It is usually believed that the degree of general intelligence a child possesses is an inherited quality, although there is some dispute on this point. There are those who claim that lack of intelligence based upon faulty mental habits may be due rather to poor environment and training.

Acquired traits. Certain traits are acquired during the lifetime of the individual, but, so far as present knowledge goes, these characteristics are not transmitted from parent to offspring. A man during his lifetime may develop immunity to a certain disease, may contract tuberculosis, may lose a leg, or may become an excellent tennis player. But none of these changes will affect the inheritance of his children. They have been acquired by the man and have not been inherited by him and are not transferable to or inheritable by his children. So no matter how great the skill or knowledge acquired by the parent, the child must again develop these qualities for himself. For the same reason, physical injuries, harmful mental states, and bad habits acquired and not inherited by the parents are not fastened upon the new generation. But these acquired qualities in the parent often play an important part as environmental influences in the offspring.

Courtesy Mr. Carl Morlok

THESE FOUR GIRLS are identical quadruplets. If, at an early stage of its development, the fertilized egg separates into two parts and each part develops simultaneously, identical twins result. Sometimes the egg may divide into three, four, or five parts, in which case identical triplets, quadruplets, or quintuplets result.

Heredity or environment. "Which is more important—heredity or environment?" is a question frequently asked. They are both important. Heredity establishes the framework and maximum development of the individual; and environment, acting on the material supplied by heredity, determines how far development shall go. So the development of each individual is conditioned by the environment into which he comes and that in which he continues. An individual of good heredity, growing in a poor environment, may achieve less in real work and real success than

Courtesy Farm Security Administration. Photo by Lee.

ENVIRONMENT influences character. Boys and girls living and growing up in such surroundings as these hardly have the best chance to develop normally and to enjoy life to the fullest.

one whose heredity is not so good but who is exposed to a better environment. No two beings have exactly the same environment. Even the experiences of twins are not identical from hour to hour and from day to day.

Behavior. An individual behaves according to the conditions that confront him at the moment of reaction. If he has eaten recently, he behaves differently from the way he does when he is hungry. If fatigued, he responds differently from the way he does when he is rested.

There are indications that behavior differences between individuals have some relationship to their glands of internal secretion. Such differences in internal secretion depend upon the genes. Individuals become changed by the experiences through which they pass and the conditions under which they live. Thus, even human beings of similar heredity may have different tastes and temperaments and different ways of responding to the same conditions.

Eugenics. The science of improving the human stock by applying the known laws of heredity is called eugenics. Domes-

Courtesy General Motors, Highways and Horizons Exhibit, New York World's Fair

MORE HEALTHFUL and safer is a community planned like this one, in which the streets are broad and the homes are away from the business and factory districts. Each home has ample space for play and other activities.

ticated plants and animals have been greatly improved by selective breeding. How effective this can be made for man, and whether eugenics is the solution to the problem of race improvement, are both much debated questions.

Eugenics may be the way of getting rid of a certain proportion of feeble-mindedness and other undesirable characteristics associated with hereditary physical defects. Criminality, pauperism, and immorality of various sorts may have hereditary causes, just as may epilepsy, some forms of insanity, cleft palate, deaf-mutism, and certain types of blindness. However, the inheritance of physical defects by later generations is subject to just as many uncertainties as the inheritance of desirable traits.

Exclusion from marriage of the obviously unfit, such as idiots and low-grade feeble-minded persons, should slowly reduce the number of defective genes to be expected in future generations. At present, society is attempting to make it difficult for the unfit to marry. At the same time, there are those who maintain that the improvement of the human race depends in large measure upon the selection of sound human stock. To this end, laws are being enacted in various states requiring medical certification of all who apply for marriage licenses.

Eugenics does not offer a remedy for present social ills. But substantial improvement may be expected from changes in environment, from the care in infancy, and from betterment of economic conditions. Through education we may hope to break down harmful tradition, modify undesirable practices, and establish higher ideals.

In conclusion

THE variations between individuals are explained by a combined effect of hereditary differences, due to parentage and ancestry, with the acquired differences from later experiences. The former differences exist as soon as the germ cell is formed, but from that time on, and especially after birth, they are constantly subject to modification by environmental influences. Every new individual represents a new combination of genes affecting physical and mental processes—a combination that may have never before existed. The way in which each individual responds to any given situation is in part a matter of original nature and in part environment. Finally, education favors certain attitudes and helps to form certain desirable habits in the individual.

Activities

1. Enumerate physical and mental traits that you may have inherited from your father, mother, grandparents.

2. Show how the Mendelian Laws are illustrated by the inheritance of a recessive trait, such as blond hair or blue eyes.

3. Name agencies (health, moral, and social) in your community for the improvement of environment.

4. Examine prepared slides of cells during division, showing chromosomes and division figures.

Test

Directions: On a separate sheet of paper write the numbers from 1 to 6, corresponding to the numbers of the statements below. Place a check mark (√) after the numbers of the statements which you think are true in connection with the deformity described, in accordance with the principles stated in this chapter. Do not write in the book.

Elizabeth was born with a deformity in her right hand. The first two fingers had only two joints. A month before Elizabeth was born, a thief had snatched a purse from her mother's right hand one evening while she was on her way to a neighborhood grocery. Her mother and all the relatives are sure that Elizabeth was marked by this occurrence. Which of the following statements do you think are true in connection with Elizabeth's deformity?

1. The deformed fingers were caused by the pain in the mother's hand when the purse was snatched away.
2. The deformity was not related in any way to the thoughts and experiences of the mother.
3. The deformity may have been intensified by the baby sucking these two fingers.
4. The deformity was probably inherited, since one grandmother has a vague remembrance of having heard of someone else in the family with the same condition.
5. The deformity was not a result of inheritance.
6. The deformity was probably due to some sort of interference by pressure of one part upon the other long before birth.

Associated subjects

Biology: Reproduction of plants and animals and the influence of heredity and environment upon their development. . . . The contributions of Gregor Mendel and other biologists to the knowledge of heredity. . . . Man is a living being, subject to biological laws.

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Home economics: Problems relating to the family and the improvement of the home environment.

Social science: Economic and social factors upon which development of the individual and of the race depend.

References

SCHEINFELD. *You and Heredity.*
SNYDER. *The Principles of Heredity.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Films

Heredity. 11 minutes, sound. Encyclopaedia Britannica.

How Animal Life Begins. 9 minutes, sound. U. S. Department of Agriculture.

In the Beginning. 20 minutes, sound. U. S. Department of Agriculture.

Reproduction Among Mammals. 11 minutes, sound. Encyclopaedia Britannica.

22. *STIMULANTS AND NARCOTICS CAN BE VERY HARMFUL*

DO YOU decide hurriedly and later regret? Or do you try to be deliberate, to think matters over carefully before acting, especially when important questions arise? Are you master of yourself and the situation, or does the situation master you? Your choice of action concerns not only yourself but sometimes the health and happiness of others. You cannot afford to lack self-control in a society where your every action is so closely bound up with the lives of others.

Do you know . . .

1. How the body may become stimulated or depressed?
2. What is the difference between a narcotic and a stimulant?
3. Why habit-forming drugs are injurious to the body?
4. What is the proper use of narcotic drugs?
5. How coffee and tea may be injurious?
6. How the drug effects of tea and coffee compare with that of tobacco and alcohol?
7. Why people smoke?
8. What is the chief drug found in tobacco?
9. Why smoking does not affect everyone in the same way?
10. How tobacco interferes with the efficiency of the individual?
11. Why athletes should refrain from smoking and from using alcohol?
12. What alcohol is?
13. How wood or methyl alcohol differs from ethyl or grain alcohol?
14. Why persons drink alcohol?
15. How alcohol causes intoxication?
16. How alcohol affects health?
17. How alcohol affects self-control and mental efficiency?
18. Why alcohol is a drug rather than a food?
19. How alcohol interferes with safety?
20. Why the use of alcohol becomes a social problem?
21. What factors are responsible for the increase in the consumption of tobacco and alcohol?
22. In what ways soft drinks may be injurious?

Natural and artificial stimulation. Conditions that speed up the movements of the body are said to stimulate it, and those that slow down activity depress it. Natural stimulation comes from partaking of food, from sunshine and cool fresh air, and from exercise and cleanliness. Warm, moist air has a depressing effect. Chemicals called hormones and waste products passing into the blood either stimulate or depress the action of the nervous system. Emotions, such as joy, sorrow, and anger, also have a noticeable effect in stimulating or depressing the body and mind.

On the other hand, there are certain chemicals called drugs that when taken into the body act upon the nervous system either as narcotics or stimulants. Narcotics slow down nerve action, while stimulants act like a whip and spur it on to greater activity. The action of a drug on the different organs of the body may vary from one that is barely noticeable to that of a poison.

Mild stimulants. Tea and coffee are regarded by many as mild stimulants. At the present time, their use is widespread in many different parts of the world. The coffee bean originally came from Arabia, and tea leaves originated in China. The stimulant in tea and coffee is called *caffeine*. Small amounts of caffeine may increase physical and mental activity, while larger amounts, such as contained in two to six cups of strong coffee a day, may interfere with sleep and the ability to concentrate, or not infrequently may cause headache or dizziness.

Drinking of coffee and tea by children is condemned by all medical opinion. Children need food to supply energy and materials for growth, not stimulation to activity. Moderate use of tea and coffee by grown people may cause little harm; excessive quantities are probably bad for anyone. Very nervous and easily excitable persons may suffer ill effects from even moderate amounts of tea and coffee. The chief reason for restricting the use of tea and coffee is the stimulating effect of the caffeine on the nervous system. Tea and coffee are often taken to drive a weary nervous system to action. Instead of a stimulating whip of this kind, rest and proper food would be far better and more effective.

Cocoa or chocolate, a similar but milder stimulant, is made from the cacao bean which originally came from Brazil and

Central America. The drug contained in the cacao bean is theobromine, similar to caffeine in chemical structure but less stimulating in its effect upon the body. Cocoa and chocolate do not have much food value except when sugar and milk are added. In the list of foods to which some individuals are known to be sensitive, chocolate has first place.

Soft drinks. Most soft drinks do not contain alcohol. They fizz because they are charged with carbon dioxide. The various kinds of pop and soda are flavored, sweetened water. They are usually harmless and of no more value than water and sugar. Some soft drinks owe their refreshing effect to the fact that they contain caffeine. The habitual use of such drinks by young people should be condemned for the same reason as the drinking of tea and coffee.

TOBACCO

What is tobacco? Tobacco is the dried leaf of a plant whose original home was in America. The early explorers learned its use from the Indians and called it tobacco because of the tube or pipe, tabaco, in which it was smoked. Later the Portuguese gave the scientific name Nicotiana to the plant to honor Johannes I. Nicotius, the French ambassador to Portugal who had introduced it into that country.

The most poisonous substance in tobacco is nicotine. In concentrated form it is a deadly poison. The amount of nicotine in tobacco varies not only in different plants but even in different parts of the same plant. When breathed into the lungs in tobacco smoke, a small portion of the nicotine enters the blood.

Effects of tobacco. Tobacco varies in its effect on individuals. In some persons, smoking seems to soothe the nerves; in others, it gives rise to headache, dizziness, insomnia, and nervous irritability. There are those who are especially susceptible to the poisonous effects of tobacco; while others are only mildly affected.

Observations show that the varying effects of tobacco on circulation include a slowing, followed by an increasing, pulse rate, a rise in blood pressure, and irregularities of the heartbeat. In some individuals, excessive smoking is said to result in a condition known as tobacco angina or spasm of the arteries of the heart. Excessive smoking may also aid in bringing about degenerative changes in the heart, kidneys, and liver. When accompanied by overindulgence in alcohol it sometimes causes blindness.

Relief from fatigue as a result of smoking comes from temporary stimulation of the adrenal glands (see p. 297). This leads to a rise in blood sugar and an increase in sugar metabolism. But the relief is of short duration and is usually followed by even greater fatigue than that which preceded the smoking.

Smoking satisfies hunger because of the quieting effect of the nicotine on stomach movements. X-ray study shows that these movements may be checked for an hour or so.

Cigarette smoke irritates the mucous membrane of the respiratory tract. Excessive smoking frequently results in a catarrhal disturbance of the nose, throat, and bronchial tubes and especially in a chronic cough (smoker's throat).

There is no general agreement as to the effect of tobacco upon mental efficiency. But medical opinion regards the use of tobacco by growing boys and girls as unhealthful and dangerous.

Those who know agree that nicotine in the blood affects particularly those nerves which control the heart and respiration. The heart action becomes irregular, breathing is shorter and more difficult in strenuous exercise, and endurance is lessened. Athletes who wish to excel should refrain from the use of tobacco.

Tobacco may be even more harmful to those who are of inactive habit and spend most of their time indoors. Susceptibility to the influence of tobacco varies considerably in different individuals.

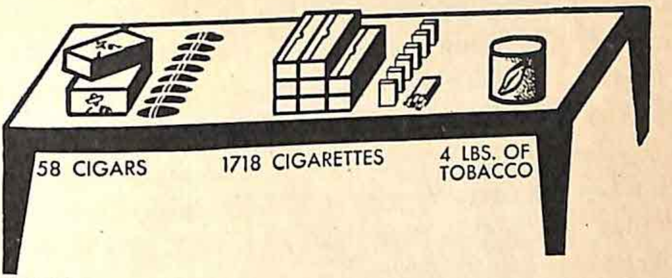
The pleasure of smoking is largely mental. The use of tobacco becomes a habit which many persons find difficult to restrain.

To smoke or not to smoke. Most smokers cannot explain why they enjoy smoking. Sociability, custom, and nervous habit are undoubtedly factors.

Many parents and teachers advise against smoking, yet many parents and teachers smoke. The use of tobacco is said to be harmful, yet there are many apparently healthy people who

INDIVIDUAL CONSUMPTION OF TOBACCO OF PERSONS 15 YEARS OF AGE AND OVER

AVERAGE CONSUMPTION PER PERSON



Pictograph Corporation

THIS PICTORIAL DIAGRAM shows approximately the average amount of tobacco consumed by each person in the United States in one recent year.

smoke regularly and some very old persons who have smoked from early youth.

Perhaps one may feel out of place when others are smoking and one has refused. What shall be done about it?

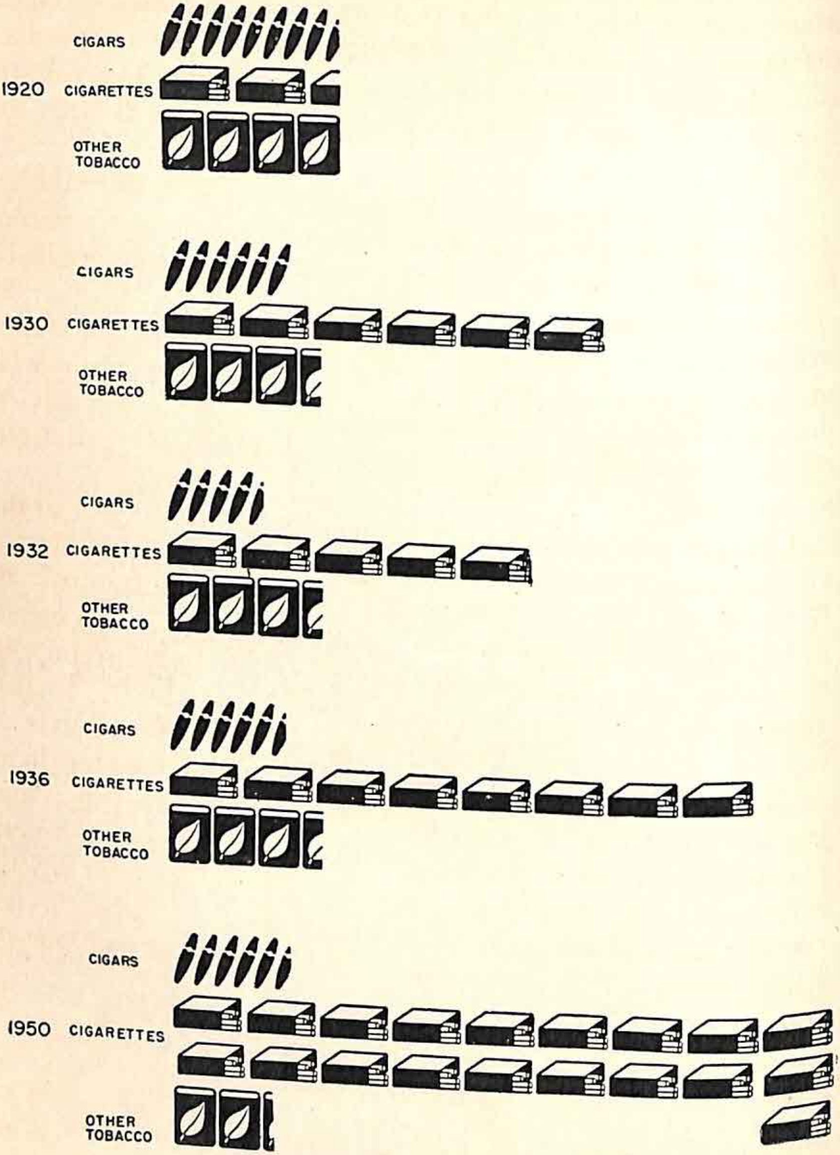
From the standpoint of health, all are agreed that those who have not reached their full stature should not smoke. A nervous person should guard carefully against excessive use of tobacco. Those with an idiosyncrasy toward tobacco should avoid it. One who has never acquired the habit may well hesitate to begin.

There is also force in the fact that the tobacco habit is an expensive one. Is it wise to spend money on a habit from which no benefit is derived and which involves certain hazards?

If possible, the decision to smoke or not to smoke ought to be made by weighing any pleasure it may give against the possible risks and cost involved. For the average adult it is undoubtedly better to smoke moderately if at all. What constitutes moderation is an individual question, not always easy to answer. In this as in other matters of health each must learn to know himself.

Consider others. Smokers are often accused of disregarding the comfort of others. Many of them apparently fail to realize

PRODUCTION OF CIGARS, CIGARETTES, AND OTHER TOBACCO



Each cigar represents 1 billion cigars
Each pack of cigarettes represents 20 billion cigarettes
Each can of tobacco represents 100 million lbs. of other tobacco

PICTOGRAPH CORPORATION

that tobacco smoke may be very disagreeable to those who do not smoke. Often the smoker's clothing and person are so saturated with stale tobacco smoke as to make him repulsive to others. Many users of tobacco throw matches, ashes, and stubs of cigars or cigarettes on floors, rugs, and sidewalks, into wastepaper baskets, out of office windows, and among dry leaves. This careless habit not only makes the surroundings unsightly but is often the cause of a serious fire.

The majority of people dislike to appear different from others. Some say that smoking is a social custom which makes for friendliness and comradeship. Smoking is an activity that cannot be classed as absolutely right or absolutely wrong. Whether to smoke or not to smoke is largely a matter of individual choice to be made with full knowledge of its effects. If a person who does not indulge in the use of tobacco respects the right of others *to* smoke, surely they, in turn, should respect his right *not to* smoke

Tobacco from an economic standpoint. In a recent year in the United States, according to the report of the Bureau of Internal Revenue, over 390,000,000,000 cigarettes were manufactured, almost 7,000,000,000 more than in the preceding year. This means more than 2,700 cigarettes for each inhabitant, or an average of almost four a day for each man, woman, and child. To this must be added over 5,700,000,000 cigars, 39,992,000 pounds of snuff, and more than 156,000,000 pounds of tobacco used for chewing and pipe smoking. Successful advertising in newspapers and magazines, over the radio, and on billboards is making the American people more and more "tobacco-conscious," and for strictly commercial reasons such advertising promotes a belief in the harmlessness of the tobacco habit. Is this consistent with our efforts to become a healthier nation?

ALCOHOL

What is alcohol? All alcoholic drinks contain ethyl or grain alcohol. In the pure state this alcohol is a colorless liquid with a characteristic odor. It unites easily with water and is an important solvent. It can be made from any solution containing sugar. Through the action of yeast cells, the sugar is changed to ethyl alcohol and carbon dioxide. The name *fermentation,* meaning boiling, has been given to this process because the bubbling up of gas through the liquid resembles the boiling of water.

Alcoholic beverages are made from fruit juice or from any plant product, such as wheat, rye, barley, corn, and potatoes, which in large part has first been converted into sugar. The amount of alcohol present in alcoholic beverages varies from 2 or 3 percent to more than 50 percent. Beer contains the least. Whisky, gin, and brandy contain the most, and because of their high alcoholic content they are known as hard liquors.

Grain and wood alcohol serve many useful purposes in the industries, particularly as a solvent and as fuel. Denatured alcohol is ethyl alcohol to which has been added some substance which makes it unfit for drinking. Wood or methyl alcohol is very different from grain alcohol. It is made by heating wood in closed vessels and cooling the vapors that form. Wood alcohol, because of its cheapness, is much in use as a fuel and for other purposes. When taken into the body as a liquid, or by inhaling the fumes for a long time, it is extremely dangerous. It injures the eyes especially, and may even produce blindness. Many deaths from drinking wood alcohol have been reported.

Alcohol in the body. When alcohol is taken into the human body it is not acted upon by the digestive juices, but passes unchanged into the blood and is carried to all parts of the body. Absorption of alcohol into the blood begins within a few minutes after it is swallowed. A small amount is absorbed in the mouth and throat, some in the stomach, and the largest part in the small intestine. Food and water or other liquids in the stomach slow down absorption of alcohol.

A large part of the alcohol taken into the body is slowly burned up, as is shown by the fact that the amount in the blood gradually decreases without much of the alcohol being thrown off through the kidneys. But some alcohol is given off through the lungs and the skin. That is why the breath, perspiration, and other excretions of a person who has been drinking smell of alcohol.

It is sometimes argued that alcohol is found naturally in the body as a product of fermentation and other processes and thus is always present in the blood and tissues. But this amount, being less than a drop of alcohol in the entire body, is too minute for detection by most of the tests for alcohol.

Is alcohol a food? Alcohol has been called a food. True, its oxidation in the body releases energy. But only to the extent to which this energy is used by the body can alcohol be considered a food. Alcohol remains unchanged until it is burned, so it cannot be used to build the body and cannot be stored for future use.

Alcohol and body warmth. Alcohol placed on the surface of the body makes the skin feel cool because it evaporates quickly and takes away heat from the body. Alcohol taken into the body makes a person feel warm because it relaxes the tiny blood vessels beneath the skin and mucous membranes and so causes a greater flow of blood to these surfaces. Since more heat is lost through the warmed skin, the blood as a whole is actually cooled. The skin temperature rises, while the internal body heat may drop below normal. Persons using alcohol in cold weather often become dangerously chilled without knowing it.

Alcohol and the nervous system. Contrary to the common belief, alcohol is not a stimulant. The feeling of exhilaration that follows the drinking of alcohol is the result of a depressant action on the higher centers of the brain which control restraint. The person who has taken alcohol talks more freely, seems to have greater self-confidence, and rejoices in a sense of well-being. This is merely because his inhibitions have been removed.

Nervous control and muscular co-ordination are definitely reduced by alcohol. Moderate amounts interfere with attention, concentration, memory, judgment, and reason. The learning process is retarded, the speed of performance is slowed down, and the tendency to errors is increased.

A man who becomes intoxicated loses control of his physical or mental faculties. For example, he cannot put his finger where he wishes but waves it uncertainly in space. He may see a red light but fails to understand its meaning. He wastes energy on useless movements. He thinks he is working harder and faster than usual but he actually does less work and tires more easily. He may not realize when he is tired so quickly as the man who does not drink alcohol. Alcohol also weakens endurance. Athletes in training have to refrain from taking alcoholic drinks.

A small amount of alcohol may not show an effect upon the senses or the muscles but may appear in the behavior of the individual. It gives a false sense of stimulation. By depressing the higher brain centers, it leaves uncontrolled the lower mental processes. Hence its first effect is to cloud judgment and dull the finer feelings. In larger amounts it still further removes the normal restraints. It is this blunting of the higher mental controls which causes people to say and do things under the influence of alcohol that they would ordinarily condemn in others. Conduct which when sober they would consider disgraceful and hazardous may seem safe, attractive, and even praiseworthy. Some persons are especially susceptible to alcohol.

Alcohol and the machine age. In the past, when men worked slowly and with rough tools, the combination of speed with precision played a less important part. Today men work with machines so sensitive and powerful that the slightest movement in the wrong direction or at the wrong time may cause serious damage. For this reason, skilled employees are often forbidden to take alcoholic drinks before or during working hours.

Alcohol and the automobile. Many tests have been made in which measured amounts of intoxicants were given to automobile drivers and the drivers' reactions recorded. It has been found that after taking even as little as an ounce of alcohol there was a measurable loss of efficiency. The driver became slower and less skillful in putting on the brakes. He had less ability to detect objects in the road and less skill in avoiding these when he did see them. He did not realize how fast he was going and could not act promptly when he had to slow down.

Most persons require about three-quarters of a second to decide that they should use the brakes, to shift the foot to the pedal, and then actually to apply the brakes. But when a person has been drinking, it may take twice as long to make this decision and carry it into effect. At 20 miles an hour, a car will travel at least

Courtesy National Safety Council

RECORDS OF ONE city police department show that, in fourteen of forty-five fatal accidents, the driver or pedestrian had been drinking. In 820 non-fatal cases, moderate drinking was a factor. Merely a drink or two impairs judgment.

50 feet before it can be brought to a stop; at 40 miles an hour, 132 feet or more—too far perhaps to negotiate the unexpected curve or to avoid the car that darts across the highway. After imbibing an alcoholic beverage, the driver often imagines himself more alert, and does not realize that his skill in driving has been lessened. Furthermore, he grows egotistical and overbearing, and insists on the right of way.

The entrance of the automobile into the daily life of all classes has greatly increased the number of people who are in control of high-powered machinery. Today, more than ever before, it is essential that each individual retain complete mastery of himself.

Alcohol in medical practice. Alcohol was one of the first anesthetics used. Its action on human beings bears some resemblance to that of ether or chloroform. But alcohol is no longer used for this purpose, since the action of ether and chloroform is quicker and more complete, and since ether and chloroform are more convenient than alcohol to use.

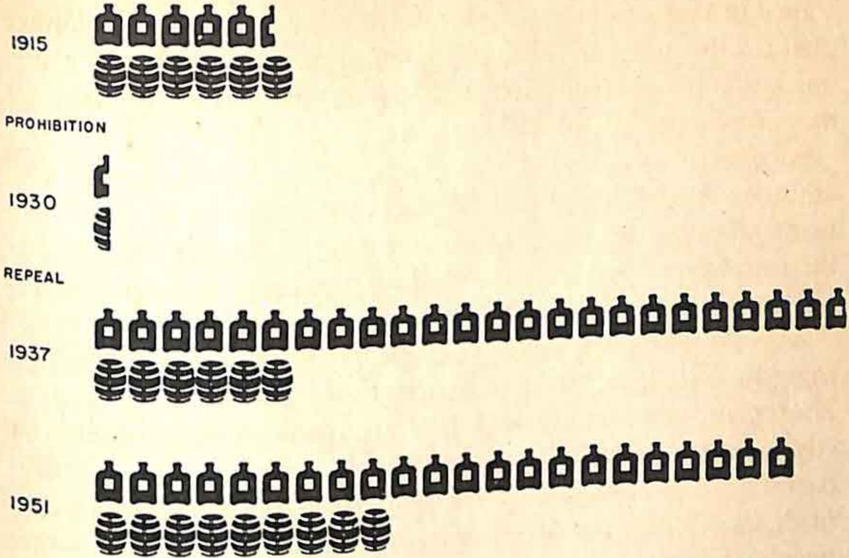
Alcohol is used less as a medicine since other substances that are more reliable have taken its place. It is to be avoided in treatment of snake or spider bites. For fainting and weakness, aromatic spirits of ammonia is a good stimulant, and has no bad aftereffect.

Alcohol is properly used as an antidote for carbolic-acid poisoning. In certain forms of heart disease it lessens anxiety and relieves pain. The reason why alcohol is such a popular home remedy is that it causes the patient to forget his symptoms. Many patent medicines depend on this effect. Persons taking patent medicines think they are getting better, but at the same time they may be developing the alcohol habit without realizing it.

Moderate use of alcohol. Experiments show that small amounts of alcohol act on body warmth, fatigue, and the nerve centers in the same manner as large amounts, although in smaller degree. Opinions differ widely as to what is meant by moderate use of alcohol. The person who drinks so-called moderate amounts is always exposed to the risk of becoming an immoderate drinker, for even a small amount of alcohol tends to weaken resistance to the desire for more.

Alcohol a traffic menace. For several years past, the reported percentages of automobile accidents due to alcohol have been increasing. Many other drivers who were potentially dangerous or who actually caused serious or fatal injuries as a result of driving while drinking have escaped detection. Alcoholic drivers and pedestrians are playing an increasing part in the accident problem.

The number of motorcars on the public highway has increased enormously in the past decade, and even clear-headed drivers find it more and more difficult to avoid risk of injury and death. Too much emphasis cannot be placed on the danger in the use of even



LIQUOR PRODUCTION IN THE UNITED STATES

Each bottle represents 10,000,000 gallons of whiskey, rum, and brandy
Each barrel represents 10,000,000 barrels of beer

PICTOGRAPH CORPORATION

a small amount of alcohol by those who operate trucks and passenger cars. In many states heavy penalties are placed on the person who is found to be intoxicated while driving.

Summary of facts about alcohol. Some of the many reasons for not using alcohol may be stated briefly:

1. It is not essential to health.
2. Acting as a narcotic, it depresses the higher centers of the brain.
3. It sets free the lowest instincts by removing inhibitions.
4. It impairs reason, will, self-control, judgment, physical skill, and endurance.
5. It has a very limited use in medical practice.
6. When used excessively, it shortens life and increases mortality, as is clearly recognized by insurance companies.
7. It frequently destroys health, happiness, and mental stability.
8. Its use may pave the way for crime or social impropriety. It is evident, therefore, that the use of alcohol constitutes an important problem in community health.
9. The normal person does not resort to alcohol to escape from un-

pleasant reality or to supply artificial courage for the ordeals of living.

10. The use of alcohol by persons carrying the responsibility for the safety of others is extremely dangerous.
11. For moral and economic, as well as scientific, reasons opposition to the drinking habit is growing in both Europe and America. Can one afford to waste money on an expensive habit that is fraught with so many dangers?

More about drugs. In addition to the stimulants and narcotics already mentioned, there are certain other drugs less widely used but more dangerous because of their tendency to form a habit. These include cocaine from the coca plant, opium from the poppy, hashish from Indian hemp, the bromides, chloral hydrate, and the synthetic barbiturates, such as veronal.

Marijuana, or muggles, similar to the hashish of India, has recently come into somewhat frequent use in parts of the United States. It is sometimes mixed with tobacco for cigarettes and pipes. It is a very dangerous substance affecting the central nervous centers, thus causing loss of control of behavior by the individual. Smokers of marijuana often suffer from hallucinations. When the drug is taken in sufficient quantities, the resulting complete irresponsibility may lead to the committing of murder and other terrible crimes. Prolonged use of the drug commonly produces mental deterioration and insanity. The sale or possession of marijuana is prohibited in all but seven of the individual states of this country.

Often drugs are taken innocently by individuals to overcome weariness, pain, or mental suffering, or to induce sleep. No one can regularly use any habit-forming drug without injury, and always present is the danger of becoming completely enslaved by it.

Drugs have a definite value in disease when intelligently prescribed by well-informed physicians. Their misuse in patent medicines and in habit-forming preparations is a serious menace.

In conclusion

EVERYONE has certain standards in life which help to make him what he is and what he is going to be. A clear mind, keen senses, a sound heart, healthy lungs and stomach, and a vigorous muscular system are desired by all. Whoever seeks to possess these to the limit of his capacity should weigh seriously the hazards discussed in this chapter.

Activities

1. List all the possible arguments against the use of tobacco. Try to develop corresponding arguments favoring its use.

2. Make a list of the reasons why you would not allow yourself to take even a small amount of alcohol.

3. Make a chart showing the industrial uses of grain and wood alcohol. (Consult a chemistry textbook or an encyclopedia.)

4. Compare advertisements for drugs in a scientific magazine and in one of the cheap magazines.

5. Illustrate from personal observation, if you can, how alcohol may be an economic question.

6. Two automobiles have had a minor collision. To revive one of the drivers who has fainted, a person living near by gives him a drink of whisky. What misunderstanding might this cause on the part of a policeman and a news reporter who arrive later?

7. Study the reports of insurance companies to determine what they have found to be the relation of alcohol to length of life.

Test

Directions: On a separate sheet of paper write the numbers from 1 to 7, corresponding to the numbers of the statements below. Place letters after the numbers as follows. Do not write in the book.

A, if you agree with the whole statement.
U, if you are uncertain how you feel about the whole statement.
D, if you disagree with the whole statement or any part.
X, if you do not understand the statement.
(Mark every statement; omit none.)

1. I believe that the moderate use of tea and coffee by adults may cause little harm and is sometimes beneficial.

2. I think that the habitual but moderate use of tea, coffee, and alcoholic beverages is not harmful and is desirable in overcoming fatigue.
3. I think that nearly every person requires some stimulant to keep him going under the pressure of modern life.
4. I believe that alcohol even in small quantities retards the reaction time of the individual.
5. I am sure that the use of alcohol in any amount by those who are responsible for the safety of others is dangerous.
6. I believe that drugs are dangerous in the hands of the layman, especially in the self-medication recommended by advertisements or friends.
7. I am sure that drugs have a definite value in disease when intelligently prescribed by well-informed physicians.

Associated subjects

Biology: The structure of yeast cells and their relation to the process of fermentation. . . . The source and origin of the stimulants and narcotics in common use and their effect upon various parts of the body, particularly the nervous system. . . . How animals and plants are retarded in their development by unnatural stimulation.

Chemistry: The manufacture and distillation of alcohol. . . . The chemical composition and uses of the various forms of alcohol, anesthetics, and synthetic drugs.

Home economics: The effect of tea, coffee, cocoa, alcohol, tobacco, and narcotic drugs on food, personal economics, and family relationships.

Physical education: The effect of alcohol upon skills and endurance and the effect of exercise upon its absorption. . . . The importance for best physical development of refraining from the use of alcohol and tobacco.

Psychology: How social situations influence behavior, and how persons with an unstable mental make-up are especially apt to suffer from variations in environment.

Social science: The history of the prohibition movement. . . . The liquor question in the United States. . . . Legislation concerning the production, sale, and use of alcohol and narcotic drugs.

References

Alcohol Problems Visualized. National Forum.
CARROLL. *What Price Alcohol?*
FISHER and EMERSON. *How to Live.*
HAGGARD and JELLINEK. *Alcohol Explored.*
MEREDITH. *Health and Fitness.*
WHEAT and FITZPATRICK. *Health and Body Building.*
WILLIAMS. *Healthful Living.*
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Films

It's the Brain That Counts. 20 minutes, sound. Chicago Film Laboratory.
The Beneficent Reprobate. 42 minutes, sound. Association Films.

23. *SELF-PRESCRIBED MEDICINE CAN BE MOST INJURIOUS*

THROUGH advertising, the producer or dealer aims to sell more goods than his competitor. Good advertising is helpful. Dishonest advertising, on the other hand, may do much harm. It does not aim to tell you what you want to know but rather what manufacturers and merchants want you to believe. Often, many subtle methods are used to do this. For example, the radio programs sponsored by certain commercial companies are designed to please. In this way you are prepared for receiving the real message of the advertiser. In a receptive mood you may easily be convinced that a certain food, toothpaste, or mineral water is not only the best in the world but exactly what you need. Such advertising is often undesirable or even dangerous, since it concerns your health. Therefore, you should not subscribe to any new notion which strikes your fancy without careful consideration and investigation.

Do you know . . .

1. What a patent medicine is?
2. How patent medicines can be recognized?
3. Why one should read the labels on patent-medicine bottles?
4. What dangers are involved in self-doctoring?
5. If it is advisable to buy any medicine at a drugstore without a doctor's prescription?
6. Why patent medicines are not so good as those prescribed by a physician?
7. In what ways patent medicines may be dangerous?
8. In what ways patent-medicine advertising makes its appeal?
9. Why testimonials are not a safe guide?
10. Why patent medicines are still permitted to make such extravagant claims?
11. How the Federal Food, Drug, and Cosmetic Act of 1938 is a protection?
12. What the "sulfa" drugs are?
13. What standards should be applied in evaluating advertisements using health ideas?

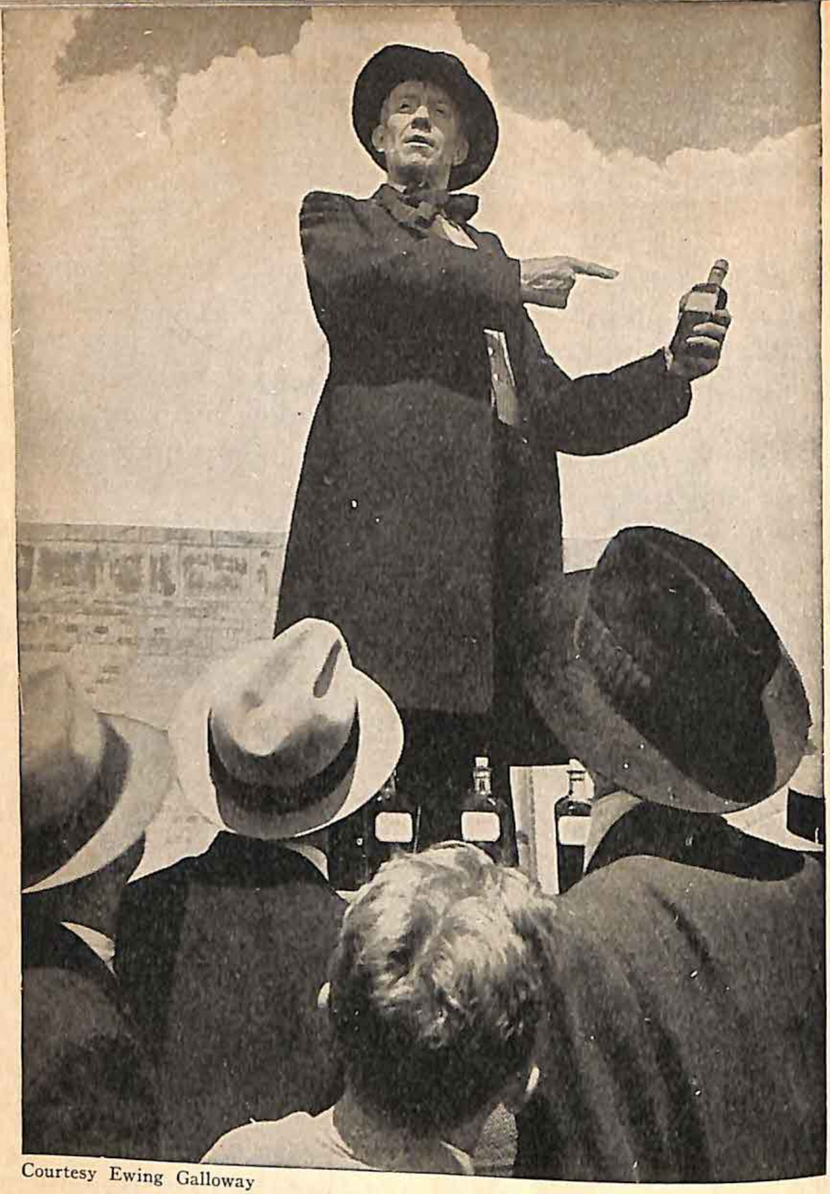
Doctoring oneself. Self-doctoring by those without expert knowledge must necessarily be unscientific, and in the presence of important conditions it often leads to serious harm. Yet each home, even if it is in a city where drugstores are convenient, should be provided with a few simple remedies and surgical dressings. Among the medicines there should be an antiseptic, such as tincture of iodine, for use on cuts and abrasions; a mild cathartic, such as Epsom salts; and a stimulant, such as aromatic spirits of ammonia (see p. 477). Emergencies do arise and one should be prepared to take care of them. If the illness persists, however, reliable medical advice should be sought.

Each year several times as much money is spent for self-medication in this country as is spent for drugs prescribed by physicians. The preparations used vary a great deal in content, purpose, and importance. Some are standard drugs of known composition, such as aspirin, soda, and Epsom salts; while others are patent medicines of unknown composition.

The doctor's prescription. Drugs are usually not specific cures for disease; but they are of value because they control undesirable reactions, support some body function, or lessen pain. A few drugs, however, have specific action on the invading germ, such as quinine which is prescribed in malaria. The physician who prescribes a drug does so for reasons adapted to the individual case.

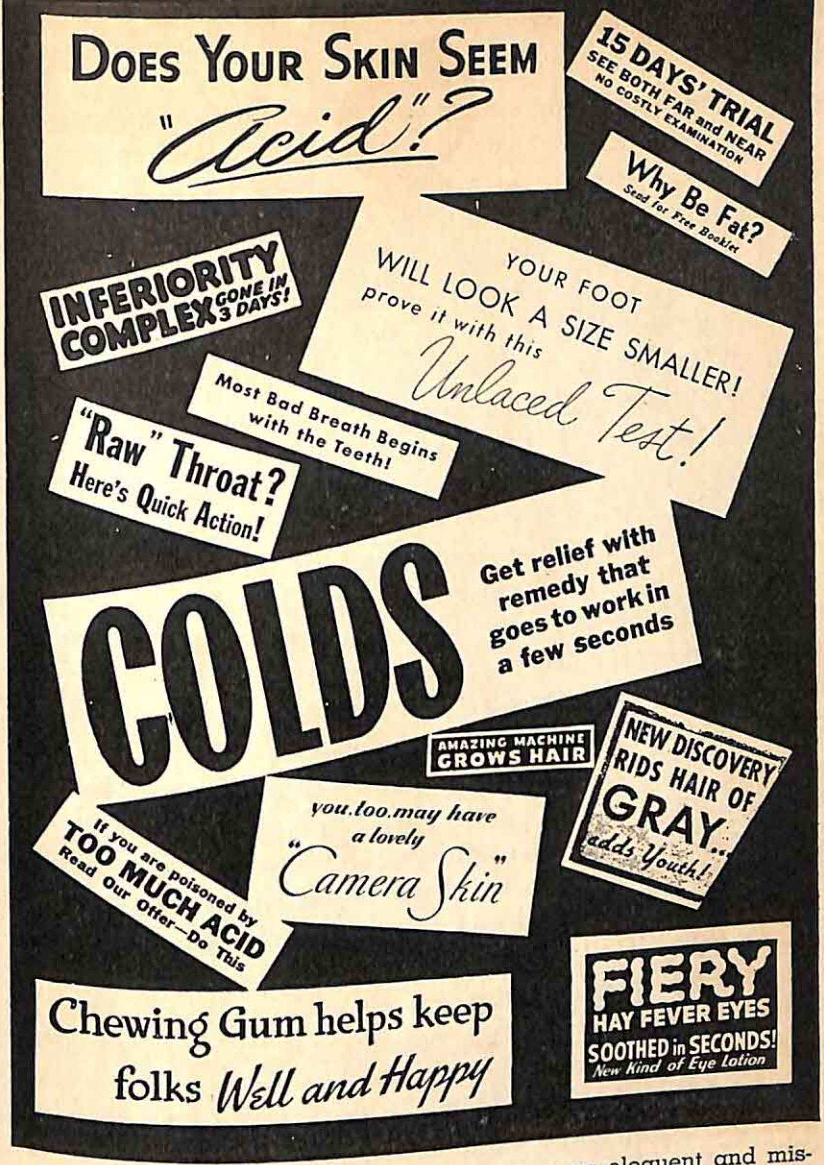
Any medicine, even aspirin or a cathartic, should best be selected and used according to the advice of one's physician. One patient with abdominal cramps may be relieved by a cathartic, while another may suffer a ruptured appendix from the same treatment. In case of persistent abdominal pain of any intensity, a physician should be consulted.

The use of patent medicine. Judging by the amount of space devoted to advertising patent medicines in newspapers and magazines and on billboards, and judging also by the many packages containing them seen on drugstore shelves, they must have a very wide sale. One authority states that an amount of $350,000,000 is spent annually on patent medicines. A patent or proprietary medicine is usually a secret compound or mixture to which a registered trade-mark has been given. Such registration gives the

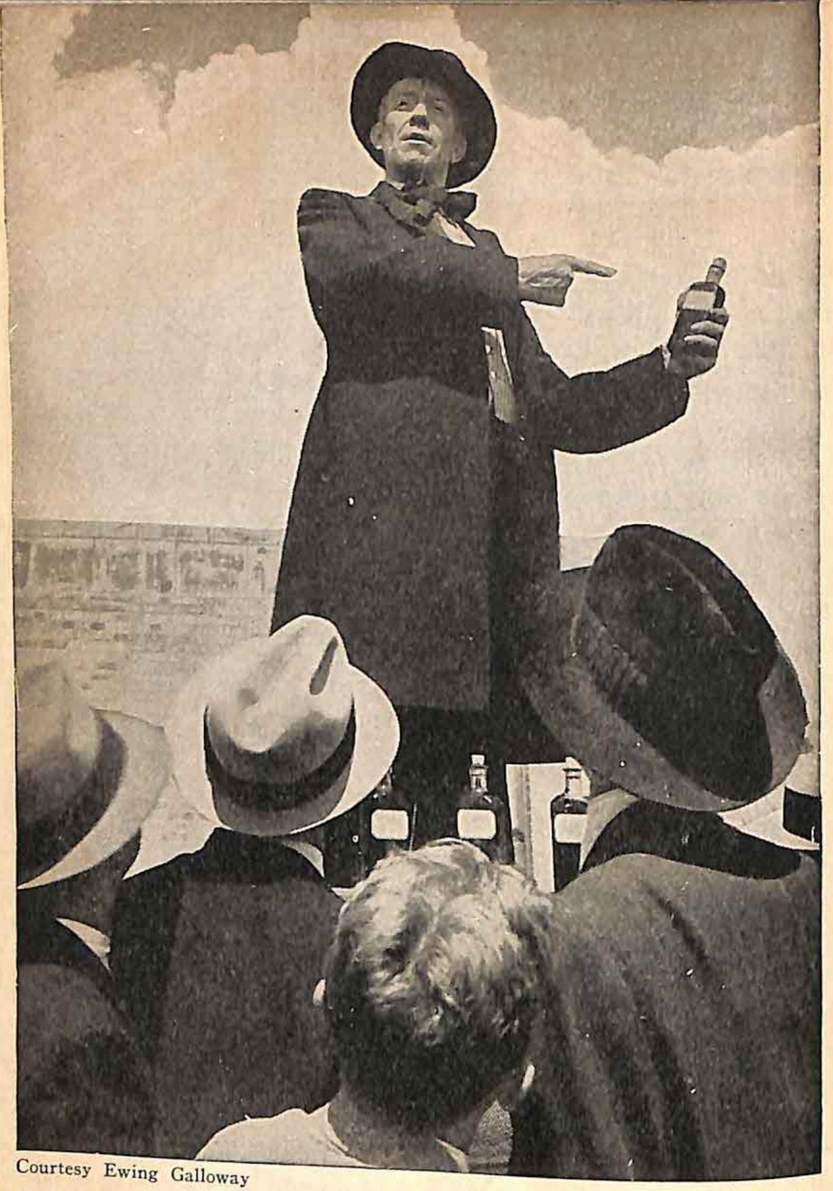


Courtesy Ewing Galloway

A GENERATION AGO medicine men traveled about the country selling useless and expensive cure-all preparations. These men depended on their eloquence and showmanship to sell their wares.


DOES YOUR SKIN SEEM "Acid"?
15 DAYS' TRIAL
SEE BOTH FAR and NEAR
NO COSTLY EXAMINATION
Why Be Fat?
Send for Free Booklet
INFERIORITY COMPLEX GONE IN 3 DAYS!
YOUR FOOT WILL LOOK A SIZE SMALLER!
prove it with this Unlaced Test!
Most Bad Breath Begins with the Teeth!
"Raw" Throat? Here's Quick Action!
COLDS
Get relief with remedy that goes to work in a few seconds
AMAZING MACHINE GROWS HAIR
NEW DISCOVERY RIDS HAIR OF GRAY... adds Youth!
If you are poisoned by TOO MUCH ACID Read Our Offer—Do This
you, too, may have a lovely "Camera Skin"
Chewing Gum helps keep folks Well and Happy
FIERY HAY FEVER EYES SOOTHED in SECONDS! New Kind of Eye Lotion

TODAY some of the claims of advertisers are as eloquent and misleading as was the sales talk of the oldtime medicine man. Do statements such as these influence you in any way when you are ill?



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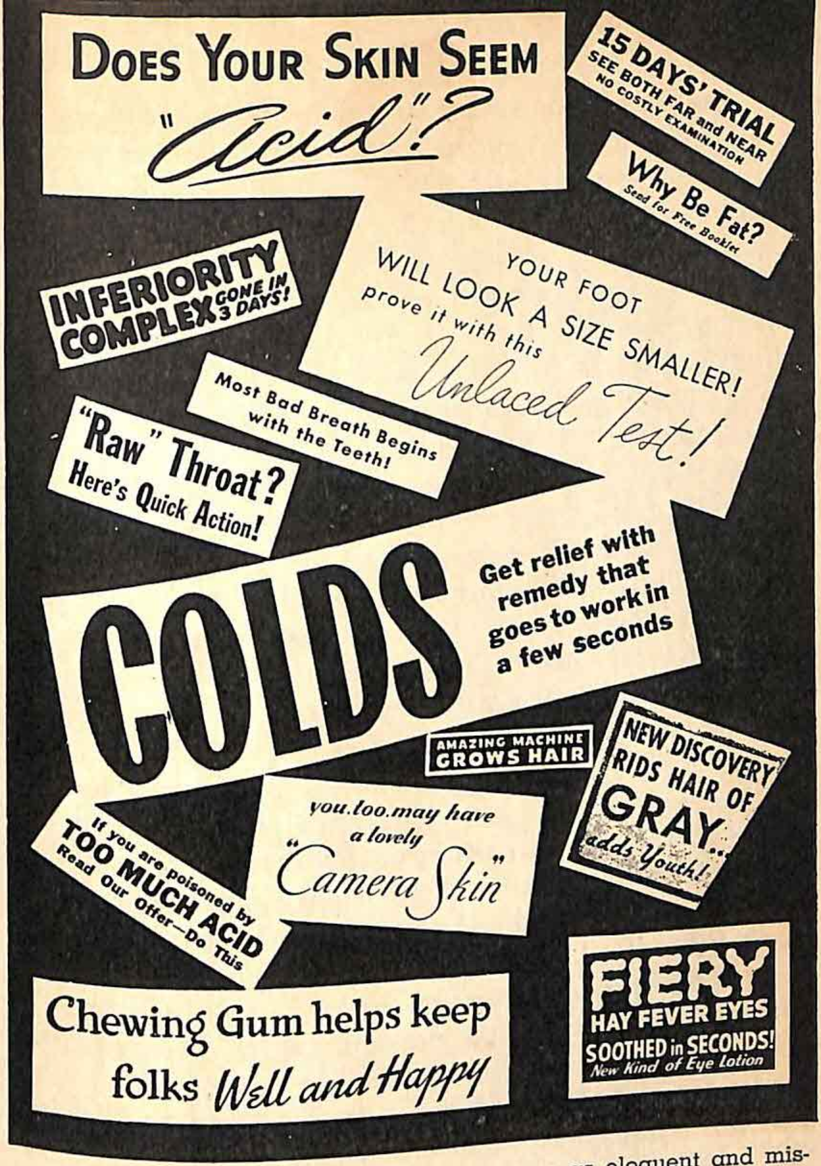
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owner a monopoly of the trade-mark, while it imposes no restrictions on the composition of the product that is sold under the trade-mark unless the contained poisons have been specifically restricted by law. Certain substances, such as alcohol and opium, if present must be indicated on the label.

People who prescribe for themselves often rely on patent medicines. Some of these medicines contain dangerous narcotics which give temporary relief without curing the disease. In the meantime the disease itself may get worse, although the person thinks he is better. He may take the drug too often or he may take too much of it. Furthermore, a drug which may be helpful in one condition may be poisonous in another.

Many persons who do not understand the cause of disease hesitate to call a well-trained physician but will read and accept instead the advertisement of some quack doctor or of some patent medicine. As real medicine is given for special symptoms associated with a special disease, it is evident that a patent medicine advertised to cure many diseases is a fraud.

The most widely sold patent medicines are generally of two types: "bracers," containing a high percentage of alcohol, which exhilarate and may produce more or less intoxication; and sedatives, containing narcotics which soothe by depressing the nerves and often the heart. A third group of patent medicines, which have no value at all, include "cures" for cancer, consumption, epilepsy, asthma, and blindness.

Laxatives. It is said that approximately three-fourths of the American people at some time suffer from constipation. Each year many millions of dollars are spent for cathartics and many new laxative compounds are foisted upon the public. The saline cathartics usually contain Glauber's salt (sodium sulphate) or some other inexpensive salt and are sold at high prices.

Certain other patent medicines sold for laxative purposes contain an odorless, tasteless drug called *phenolphthalein*. Only a small amount of this drug is necessary for a decided purging effect. It is concealed in candy tablets, in pills, or in chewing gum. Like most poisons, phenolphthalein may be harmless if taken in small doses at long intervals. But not all persons are alike in being able to tolerate this drug, even in small amounts. The reactions which result may vary from a skin eruption to severe irritation of the kidneys. These candy laxatives are sometimes fatal to children who have mistaken them for candy. The repeated use of laxatives of any kind may develop into a habit and the candy laxative may encourage this habit early in life.

The ill-advised and habitual use of laxatives tends to increase constipation and does not remove the cause. Intelligent treatment of constipation depends upon the removal of conditions which produce it. Prevention, however, is worth more. This depends upon a daily schedule that includes a well-balanced diet, adequate drinking of water, some regular exercise, nervous relaxation, and the regular habit of emptying the bowels each morning, usually after breakfast.

Obesity "cures." The desire to be slender beyond what is best for health or even attractiveness has caused many women to waste money on treatments that were either dangerous or worthless or both. These have included elastic belts, vibrating and exercising machines, diets for reducing, bath salts, soaps, creams, and drugs for internal medication.

One type of obesity cure prescribes a saline cathartic for reducing weight. The cathartic prevents absorption and assimilation by hurrying a large part of the food through the intestine before it can be properly digested.

Other reducing medicines contain dried thyroid extract. Its action upon the body is to increase the rate of metabolism (see p. 296), and thus cause some loss of weight. It is a very powerful drug and should never be taken without the advice of a competent physician.

A few years ago it was discovered that *dinitrophenol,* a coal tar product, would increase the rate of metabolism. This drug has since been used, either alone or in mixtures with fancy names, for the reduction of weight. As the rate of metabolism is increased, the food is burned more rapidly, and this results in loss of weight. Dinitrophenol is poisonous to everyone and has frequently caused death. Cases have been reported in which patients, usually women, developed blindness from cataracts induced by this drug.

would destroy bacteria causing intestinal diseases. The chemical substance produced by these soil bacteria is streptomycin (streptococci-killer). This drug has been found generally effective in the treatment of infections of the intestinal and urinary tracts. Experimentation is still going on, but there is some evidence to indicate that it can be used effectively in the treatment of typhoid fever, undulant fever, and some kinds of food poisoning.

These powerful new agents against disease may produce disastrous results if used improperly. Thus, the sulfa drugs may cause skin rashes, nausea and vomiting, abdominal pain, dizziness, injurious changes in the blood, and even death. None of these drugs should be used except upon the advice of a physician.

Cold remedies. Patent remedies for colds have little or no value, so the claims made by advertisers are misleading. These remedies often harm by encouraging people to continue at their work when they should be in bed. There is some evidence that the use of medicated oils in the nose during the acute stage of a cold, although giving temporary relief, tends later to increase the irritation of the inflamed mucous membranes. Oils may interfere with breathing if they cover the respiratory tissues, as might occur when given by nose or mouth to babies. Gargles are useful only as a cleansing agent and in the temporary effect on the blood circulation in the throat.

Ephedrine, a drug found in nasal jellies and solutions, brings relief by shrinking the mucous membranes. This and related drugs should be used only upon the advice of a physician because of certain unpleasant reactions resulting from their excessive use.

Tonics. The widely advertised tonics of the "bracer" type of patent medicines depend largely for their effect upon the alcohol which they contain. This may vary in amount from 17 to 45 percent. Many of these remedies, fostered by advertisements, are in great demand because they are thought to promote the well-being of the body. In some cases the effect is largely imaginary, while in others the large quantities of alcohol contained present a risk of developing chronic alcoholism.

Cosmetics. The majority of cosmetics of today carry no health hazards. Their prices are often absurdly high and their advertising fantastic. For simple preparations that do no more than soften and lubricate the skin, the advertisers often make extravagant claims as to nourishing the skin and opening and closing the pores.

Among the dangerous cosmetics are various hair dyes and hair removers. The aniline compounds contained in certain hair dyes may cause serious poisoning in those who are particularly susceptible. The metallic salts contained in other hair dyes may cause lead, silver, or mercury poisoning. Eyebrow and eyelash preparations have sometimes caused blindness from the aniline dyes which they contain.

There are no hair removers that will remove hair permanently. The hair is temporarily removed by strong chemicals such as barium and sodium sulphide or thallium sulphate, a rat poison. Freckle removers often contain an injurious mercury salt.

The patent-medicine business. This business continues to thrive as a result of advertising that seems convincing and often appeals to fear. Certain persons are easily influenced by testimonials that are fraudulent or valueless. Frequently such testimonials were not written by the persons named. Others have been written by persons who believed at the time that they were benefited but who have since died of the disease mentioned. Still other testimonials have been written by unscrupulous persons who were paid for doing so.

Think twice before you take. Much helpful information can be gleaned from advertisements. However, the statements made should be carefully analyzed and evaluated before one makes up his mind whether or not to buy. This is especially important when the advertisement concerns matters of health. Such questions as the following should be answered if possible:

Are the statements definite and informing, or are they vague and misleading?

If a definite statement is made, has sufficient genuine evidence been given to support its truth?

Are the statements based upon scientific investigation?

Is the information that is given what the buyers need to know?

Is the person whose approval is quoted an acknowledged authority?

If the product is known to be a good one, does the advertiser maintain that it is the only good product of its kind?

Does he claim perfection or that the product is a new development or discovery?

Does the advertisement appeal to fear?

Does the product contain harmful drugs?

Everyone is hampered in his evaluation by not having sufficient information. Unless a person knows the characteristics that indicate desirable qualities, he cannot understand facts that are stated. This makes self-prescribed medicine dangerous. Private organizations which are attempting to inform the public are Consumers' Research of Washington, New Jersey, and Consumers' Union of United States, New York City.

Food and drug legislation. As discussed in Chapter 27, the Pure Food and Drugs Act of 1906 prohibited "false and misleading" statements regarding composition, source or origin, and curative effects. It required the manufacturers of patent medicines to declare the presence and amount of only the following drugs: alcohol, morphine, opium, cocaine, heroin, eucain, chloroform, cannabis indica (Indian hemp), chloral hydrate acetanilide, and their derivatives.

The Federal Food, Drug, and Cosmetic Act, passed by Congress in June, 1938, has remedied certain weaknesses of the old law. This new law requires more informative labeling both of food and drug products, outlaws dangerous cosmetics, except poisonous coal-tar hair dyes which must bear a warning label. It controls the marketing of new drug products, requiring that all new drugs be tested and carry labels warning against habit formation if they contain any of the listed narcotic and hypnotic drugs. It prohibits slack-filling and deceptive containers and requires factory inspection. It does not provide full jurisdiction over false advertising, unless carried on the containers themselves. All other advertising has been placed under the control of the Federal Trade Commission.

In conclusion

HE WHO wishes to be physically and mentally efficient will not rely upon self-administered drugs to meet emergencies or the strain of modern living. Instead, he will seek reliable advice if an ailment arises and health is impaired. He will use the kind of health knowledge that will help him to recover. Furthermore, he will try to improve his health habits so as to remain as well as possible.

Activities

1. Make a list of sedatives advertised in current magazines. How would you suggest that the sale be restricted?

2. Write to the United States Department of Agriculture for pamphlets called *Notices of Judgment Under the Food and Drugs Act,* and see why the drug preparations listed there have been condemned.

Test

Directions: On a separate sheet of paper write the numbers from 1 to 4, the statements corresponding to the numbers of the suggestions given below. After each number indicate by a check mark (✓) the advice that you regard as good and by a cross (✕) the advice you consider poor. Also state the reasons which you find in this chapter or in other parts of the book for each of your decisions. Do not write in the book.

Robert has not been feeling well for the past two days. Today he came home from school suffering from a severe pain in the abdomen. Robert's mother, who became greatly worried, sought the advice of her nearest neighbor. That Robert came home from school sick spread quickly in the neighborhood and other neighbors came in to help. Whose advice do you think was best in this emergency?

1. Mrs. A. suggested that Robert go to bed with a hot-water bottle to make him comfortable. She also remarked that there was no need to worry. Each of her six children occasionally had a stomach-ache from which he recovered within an hour or two.
2. Mrs. B. said that Robert should take a candy laxative to clear his bowels.
3. Mrs. C. said that Robert was very sick and a physician snould be

Hazards to health in a modern world. No one has so much health as he might secure, since much of the time his body is not properly cared for in regard to food and drink, air and sunshine, correct breathing, sleep and rest, work and recreation. Health is further interfered with by the enormous mental tension and fatigue resulting from the rush and hurry everywhere present in modern society. Even in school we sometimes dash madly from one thing to another, we rush to our lunch, eat in ten minutes, and then dash off to a physical education class or a swimming lesson.

The complex life. The complexities of modern living are evidently here to stay. Machinery has keyed up the speed at which work and play and many other activities are carried on. The rapidity of change is emphasized by the following facts:

> In 1900, not one family in a hundred owned a horse and buggy; today, four out of five have cars. One family in thirteen had a telephone; now, two families in three. In 1900, modern plumbing and central heating were luxuries; less than 500,000 homes had electricity; radio and electric refrigeration were unknown. Today, more than 21,000,000 homes have television; 19,000,000 families use electric refrigerators; more than 46,000,000 have radio receivers.[1]

Civilization has contributed richly to our physical comforts, but it has greatly complicated our social adjustment. The number of human wants is constantly being extended, and often beyond the means of personal satisfaction. Every individual is obliged to meet demands on his nervous energy that would not have been made a generation ago.

Relaxation essential. While energy is being expended so freely, the nervous system tends to be overstimulated. Chronic fatigue shows itself in irritability and tense muscles. These are warnings that relaxation is needed. The symptoms should be recognized and heeded before the breaking point is reached.

Relaxation of the body is most complete when lying down. Short periods of relaxation during, and at the close of, the day's work are helpful in restoring physical and mental balance. To

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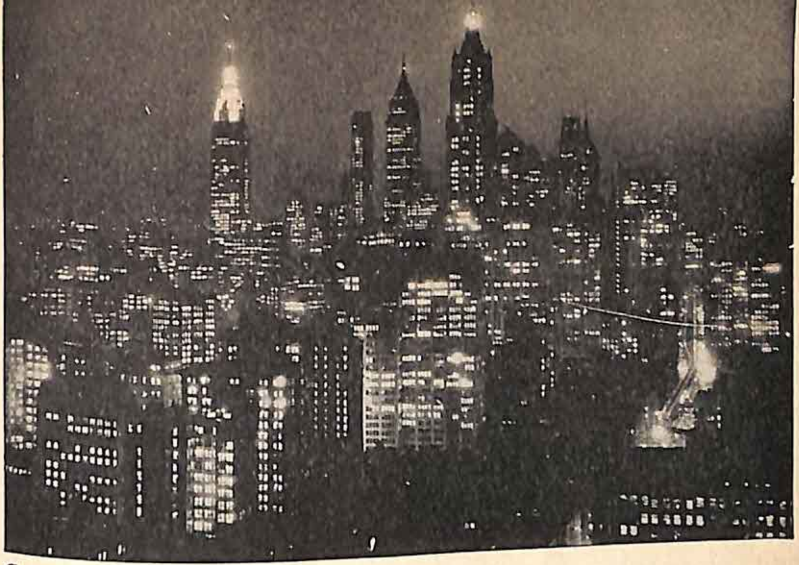
[1] Edison Electric Institute.



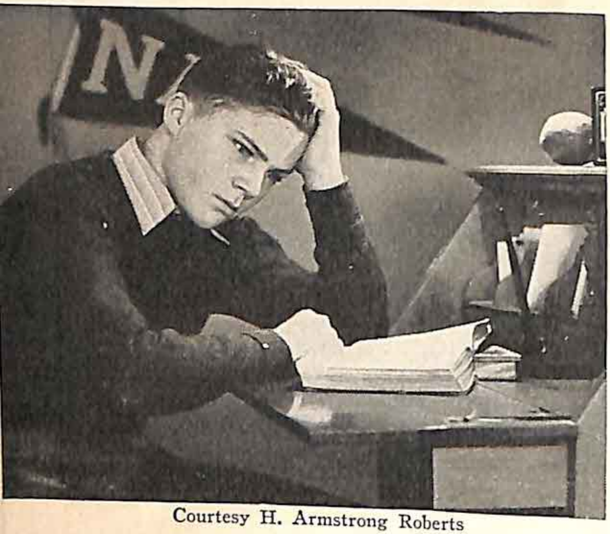
Courtesy Ewing Galloway

WHETHER we live in the crowded city or in the small town, we are constantly aware that we live in a world of people.

relax means to loosen. Relief of muscular tension equalizes circulation and makes one feel rested. Athletes acquire ability to relax and to make a few minutes of rest count. Everyone should cultivate this ability to relax.

Each individual must learn for himself how to avoid being tense. To alternate work and rest at short intervals may fit one type of person. Others may need a prolonged period of complete rest. Many can relax by change of activity. Periodic relaxation is often most successfully accomplished by pleasant mental or physical occupation which diverts the attention from the usual line of work or thought. Agreeable conversation, excursions into the country, reading, attending the theater, and outdoor sports are satisfactory means of recreation. However, it is possible to carry any recreational activity beyond the point where it is beneficial. We must not forget that sometimes there is danger of greater exhaustion resulting from our supposed recreations than from our daily work.

Minimizing emotional strain. Perhaps the most certain way of becoming tense during work is to think disagreeably or anxiously of the task which has to be performed. Hostility toward the task not only increases friction and tension but reduces skill.



Courtesy H. Armstrong Roberts

DAYDREAMS are often an escape from reality. They should instead be an inspiration for work. Usually you have ability along the line on which you are musing.

Repeated failures resulting from the attempt to do tasks beyond one's capacity often cause emotional strain. Such emotional strain can be avoided by concentrating completely and cheerfully upon the best method of accomplishing the task.

Much routine work may be done automatically. But there is less emotional strain if a proper amount of attention is devoted to doing such work than if the mind is allowed to wander excessively. Fatigue may be relieved by occasionally changing from one type of work to another. Deliberate and cheerful persistence at a task which at first seems disagreeable, may cause it to become interesting and even fascinating from sheer sense of accomplishment. Yielding too hastily to early feelings of fatigue and displeasure will steadily tend toward laziness and inefficiency.

Children and adults alike often stay up past bedtime. But it should be remembered that devoting proper time to rest will usually result in doing more work with greater efficiency and less discomfort.

Mental health. It is just as important to develop good mental habits as good physical habits. We need to learn to think clearly and to strive for poise. Poise expresses itself in calmness and self-control, in spite of the pressure of circumstances and surroundings. Lack of poise is often described as nervousness. A person who is nervous is easily disturbed emotionally and wastes a great deal of energy in doing what he tries to do. He may get angry easily, often violently angry. He may easily take offense or become discouraged or may be oversensitive to criticism. The real test of

Courtesy Board of Public Education, Wilmington, Delaware

TAKING PART in panel discussions helps to develop personality.

mental health is the ability to get along with others with a minimum of friction.

Mental hygiene is the science of preserving mental health. It is of greater importance today than at any time in the world's history. Its chief concern is to study, understand, and direct the forces which are responsible for the formation of personality. It attempts also to apply such knowledge to the reconstruction of poorly balanced personalities.

What is personality? Personality distinguishes one individual from another. It is the total effect of many qualities, inherited and acquired, and is responsible for the impression which one makes upon others. We impress others through our general intelligence, our interests and behavior, our speech, our clothing, and our physical characteristics.

Personality is developed through experience. A sound and healthy body is a good foundation for a desirable personality. By the time one reaches high school, certain practices have been fairly well established. Some of these are good; others are undesirable. A growing personality tries to overcome undesirable qualities and acquire good ones.

Alertness, strength, courage, and hope usually accompany good posture; while indifference, discouragement, illness, and fear are frequently associated with poor posture. The voice always attracts attention and makes a lasting impression on the hearer. Tone of voice, pitch, inflection, rapidity, and ease of speech all stamp the individual.

Speech is the most important agency of social adaptation. Monotonous and indistinct speech detracts from personality. Words should be carefully chosen and should be used correctly. It is often necessary to vary conversation to suit the interests of the listener.

Friendliness, thoughtfulness, tolerance, and a spirit of co-operation are aspects of behavior which tend to make up a pleasing personality. Aspects of behavior which tend to make one unsocial are excessive sensitiveness, selfishness, snobbishness, impatience, and thoughtlessness of others. Persons who show consideration for the feelings and problems of others, and who enjoy doing things for others, have acquired a social point of view. To be considerate of the welfare of one's associates is as much a part of human nature as is concern for one's own welfare.

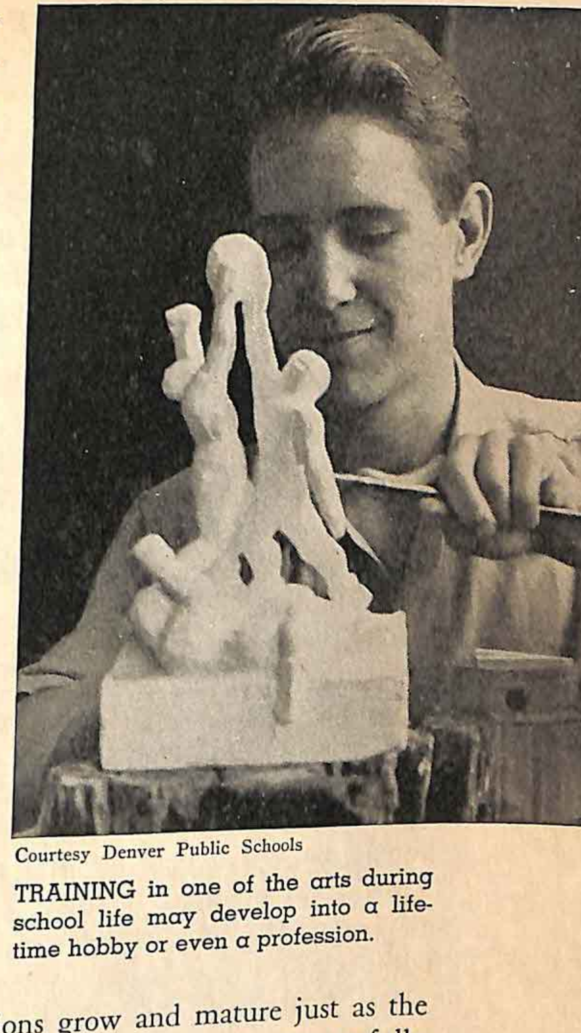
Why people act as they do. One child may cry if struck by another child. Another child in the same situation may strike back. One young man when introduced to an attractive girl says: "May I walk with you?" Another young man in the same situation finds himself to be all arms and legs and with no voice.

One man when confronted by a serious social problem says: "Let's talk it over." Another in the same situation may say: "We shall have to resort to force."

Why do men and women behave as they do? No one can give a complete answer to this question. We do, however, know about some of the factors which cause people to act as they do.

All human beings possess certain inborn tendencies or urges to action. Some of these are related to hunger, self-preservation, and race preservation. Fear may give rise to cold perspiration or the desire to run. Akin to this are anger and the urge to fight. Parental love and tenderness are related to race preservation. These urges arouse emotions which give birth to thought and action. They become modified or conditioned through experience and in time vary greatly from those with which the individual was born.

Personal behavior is shaped by what the individual has learned. If he is convinced that inborn tendencies entirely regulate his actions, there is little chance for modification in behavior. To the extent to which he recognizes himself as free to learn, he can modify his behavior and has the power to plan his life according to worthy purposes.


Courtesy Denver Public Schools

TRAINING in one of the arts during school life may develop into a lifetime hobby or even a profession.

Emotional maturity. Emotions grow and mature just as the body grows and matures. By emotional maturity is meant a fully developed ability to control and regulate the expression of feelings. A very small child cries when he is refused something. Crying also forms part of the pattern by which some older people gain their ends, but it is looked upon as a childish trait. The mature adult accepts reasonable deprivation without undue distress or rebellion.

The emotions of most adults fall between the two extremes of conduct, the childish and the mature. Some persons are grown-up physically but children emotionally. Emotional maturity does not mean blind acceptance of all deprivations. It does imply, however, definite control over one's emotions, and it means foresight and planning to meet the situations in which one finds oneself.

Everyone at some time or other is guilty of immature behavior. This is very likely to appear in his reaction to criticism. Each individual needs to cultivate the attitude of accepting criticism in a friendly, thoughtful manner without anger or ill feeling. If the criticism then seems reasonable, he should try to make adjustment without feeling resentful.

To be able to meet a serious disappointment is a very real test of the power of the individual to adjust. One may react in a healthful way to a disappointment, either by abandoning the unattainable wish or by substituting another goal which promises more chance of being realized. In either case he should as soon as possible cease to feel pain, anger, or bitterness over the failure.

Emotional conflicts. In a general way, emotional conflicts develop when the individual has not learned how to control or throw off his emotions. The problem of happy living involves not only the realization of one's desires but also the regulation of those desires in accordance with the needs and demands of the social group in which one lives.

The demands which social groups make upon the individual vary greatly in different societies. Thus the customs and traditions of family life in the United States and in China are quite different. But each social group has certain rules or standards which it asks individuals to observe. Sometimes those rules are very definite and remain unchanged for decades or even centuries. At other times, or in other societies, such rules are changed swiftly. One of the major causes of emotional conflict in our own society is a lack of agreement about many of the rules for social behavior. Some people contend that many of these rules need radical change and are being changed in the natural course of social development. Others contend that we should cling to the rules of the past. It is unavoidable that these different points of view should create much confusion. Each of us must try to think these matters through for himself and, upon the basis of such reasoning, try to develop such habits of behavior as will give him reasonable emotional stability.

Satisfaction comes in the selection of activities which conform to the needs of the group and at the same time permit the individual considerable freedom of behavior. Disappointment often results when one cannot accomplish the thing one wishes to do at the time the interest is keenest.

In situations of difficult adjustment, individuals often seek satisfaction in the use of drugs to relieve the strain of worry. In Chapter 22 attention was called to the dangers involved in the fact that the narcotic drugs, including alcohol, give a misleading and temporary but dangerous release from the hard facts of life.

Environment and personality. In Chapter 21 it was explained that heredity provides the stuff or raw material for personality, whereas environment does the shaping and developing. Environment includes all the forces which affect growth and development. Our earliest environment is the home. This soon grows to include the neighborhood in which we live, the school we attend, the companions we have, and all those whom we meet outside the family circle. Indeed, all of those persons whose lives in any way affect our own are parts of our environment. Modern environment includes a great number of people, those in our own country and those in many other parts of the world.

The family. Perhaps the most significant force for development of healthful personality is the family group. Here should be provided opportunity to obtain happiness through growth of character. Sound development of character does not take place unless people live together happily and take a wholesome interest in each other's activities.

A successful home is a co-operative enterprise from which each member of the family gets something, giving something in return. No home can be complete or successful that does not aim at a sharing of its burdens by each member of the family. Conversely, those parents do the most for their children who develop in each child an understanding of his responsibility to the home and a desire to be a co-operating member of the family group. Thus may he contribute to his own happiness and to that of others.

Growing up. During the first years of life the interests and activities of the child center about his own wants and what is likely to satisfy them. At this time, almost wholly, he is a self-centered individual, and his activities appear to be purely selfish. He is constantly trying to get other people to do what he wants. He is vain and likes to show off before others. He craves admiration and attention. A good foundation is most likely to be established if he is let alone as much as possible and allowed to make his own contacts with the natural environment. If he receives too much care and attention, he may become spoiled. Patterns of behavior acquired under these conditions frequently become permanent. During earliest childhood, many lasting impressions are made that tend to shape the whole trend of adult life.

At seven or eight years of age the normal child gradually shows more interest in the welfare of others, and a background for social education is established. By this time, habits of physical health—including proper choice of food, and regularity of sleep, rest, eating, and exercise—should have been established. Regularity in emptying the bowels is important in the digestion of food. Proper attention to neatness and cleanliness helps much in giving the child a sense of self-respect. These habits do much to carry him through life with a minimum of friction and annoyance. They also lay a foundation for mental health.

Adolescence. Adolescence is the period of life between childhood and maturity. It covers approximately the teens from twelve to twenty years. No sudden change in the growing person definitely marks the beginning or the end of adolescence. The "growing up" which occurs during these years brings with it many problems of adjustment. It is a period of relative mental and physical instability during which the normal individual abandons childish behavior and takes on the ways of the adult. The adjustments are complicated because the adolescent has to learn to live with himself or herself as a changed individual and at the same time must learn to fit into a new set of social relationships.

Not only the rapid physical growth, but the self-consciousness associated with this development, causes awkwardness and embarrassment in managing hands and feet, in wearing clothes, and generally in manipulating a bodily machine which has not yet developed mature co-ordination and skill in its changed size and form. It is a time of many new interests, new activities, and new companionships. One of the most important adjustments of this period is that of learning to associate with persons of the opposite sex. This, especially, often causes awkwardness and self-consciousness and sometimes induces a self-distrust and a sense of inferiority.

Serious conflicts in personality may show themselves. Conflicting desires may pull in opposite directions so that adjustment as a whole person is difficult. The adolescent wants to be independent and chafes because his parents do not permit so much freedom as he thinks he should have. During this period he should grow in ability to solve his own problems and to control his own behavior satisfactorily.

Maturity. Mark A. May[1] points out that the normal sequence of events in the life career of American boys is first school, then employment, then marriage and a new family. A similar culture pattern applies to girls, with whom in very many cases employment has also become a preliminary to marriage.

When adulthood has been reached, the individual should be able to stand alone, unprotected by parents and teachers. He now has to meet the problems of earning a living and founding a home. The best adjusted personality is one in which there is a harmonious union of physical, mental, and social habits and interests. A person so adjusted does not try to run away from unpleasant facts or serious difficulties, but aims to use the best judgment available in making wide choices. He takes things impersonally, is not afraid to make mistakes, does not offer empty excuses, criticizes as little as possible, does not worry over what people think about him, does not vainly regret the past, and can face the future courageously.

Wishful thinking. It is a human failing to do the things that our habits and desires lead us to do and to invent our reasons later. Such rationalization or wishful thinking is an attempt to make

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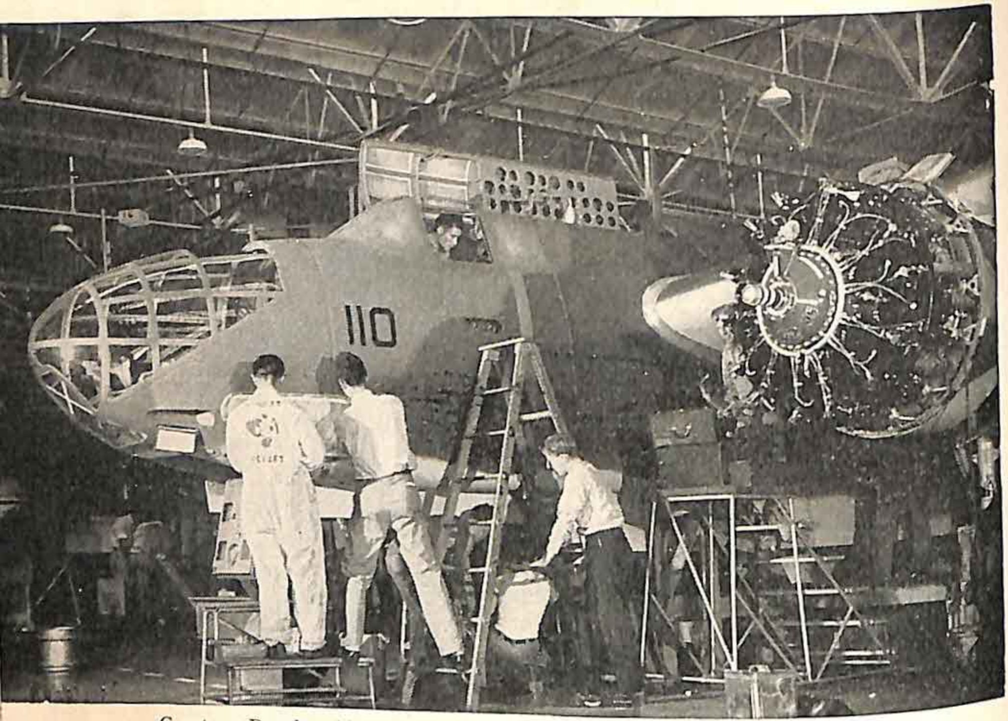
[1] Mark A. May, "The Dilemma of Youth," *Progressive Education*, XII, No. 1 (January, 1935).



Courtesy Douglas Aircraft Co., Inc.

THE FINAL installations are being made on a plane. To work successfully on this responsible task requires special skill and training and the ability to get along with fellow-workers.

unreasonable behavior appear reasonable. The term *rationalization* often implies politely that the individual lies to himself. Human nature seems to be reluctant to face unpleasant facts, especially those which cause a sense of inferiority. This is seen in the way immature persons react to criticism. They dislike to admit that they are even partly at fault, so they invent reasons to justify themselves or to explain away their mistakes. The pupil blames his unsatisfactory work on the teacher rather than on lack of application and study. He complains that the teacher does not explain clearly or that the teacher dislikes him and judges his work unfairly.

Getting along with others. The person who gets along with others is courteous to both young and old. He considers consequences to himself and others before acting. He recognizes

Courtesy Miami Chamber of Commerce

HOME CRAFTSMANSHIP provides interest and gives satisfaction in achievement—both of which are food for healthy minds.

authority, knowledge, and experience. He is able to follow directions and is willing to work under the guidance of others when the need arises, co-operating to the fullest extent.

He knows how to submit to reasonable limitations relative to the little things of life in order that the important things may be achieved. He may wish to drive at high speed through a busy thoroughfare, but he recognizes that society has set up certain regulations by which to protect the whole group and he accepts this necessity as more important. He tries to be prompt in keeping engagements, realizing that much depends upon punctuality. He maintains a sense of humor which helps him to meet smoothly the tiresome and difficult situations of life. He cultivates sympathy, tactfulness, co-operation, tolerance, and consideration for others.

Life's little courtesies. In making the most of oneself, good manners play an important part. The attitude which grows from the desire to show consideration for others is always reflected in

Courtesy Denver Public Schools

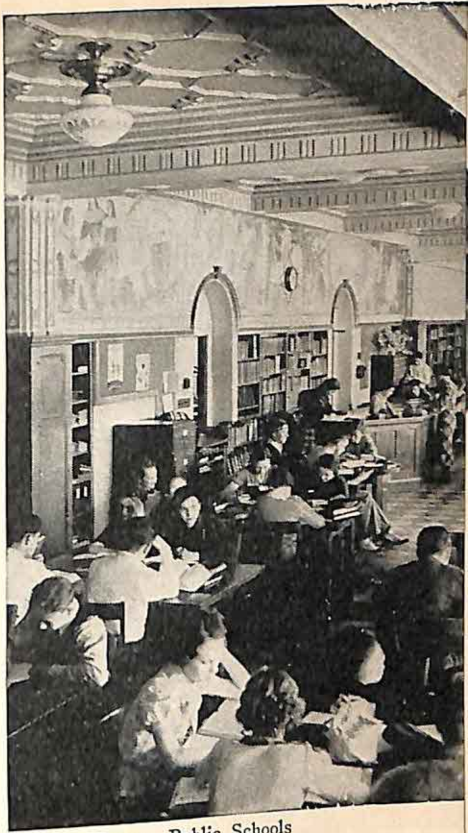
CREATING something by combined efforts teaches co-operation and admiration for others and their work.

romance or sentiment. It is for the girl to decide whether it is friendship or sentiment that she wants, and it is for the boy to accept her decision on the basis of good comradeship when she has the courage to make it.

Boys and girls should play and work together. In so doing they overcome the shyness and restraint associated with adolescence, and they gain other experiences by which they will later guide themselves as men and women. Ability to move in human society with ease, freedom, and naturalness has to be learned through practice.

Contrary to much that is said, high school boys and girls, as a whole, are today exercising greater restraint and moderation in personal behavior than in the past. They are more mature, more considerate, more co-operative. They may be frank and outspoken, but their practices are more likely to conform with their beliefs, whether these be good or bad.

Choosing a life partner. The choice of a life partner does not commonly belong to the high school period. One should recognize, however, that the associations, attitudes, and social qualities formed in this period will have an important bearing on the selection of a mate at a later time. It is desirable at this time for friendships to be formed with a number of worth-while persons of the opposite sex. It is unfortunate for anyone to be too greatly limited in opportunity for acquaintance with the kind of person whom he or she might ultimately select as a life companion.



Courtesy Denver Public Schools

HOURS of relaxation may profitably be spent in libraries. Here, through reading, one can reach out into ever broadening fields of interest.

Playing together. Leisure time affords opportunity for both physical and mental self-improvement. We are able to cultivate new interests and to discover new friends.

As we journey through life, personality can be enriched through such activities as music, reading, writing, gardening, nature study, and outdoor sport. Hobbies, such as photography, painting, or making collections, broaden outlook and increase knowledge while giving a great deal of enjoyment.

Perhaps there is no more wholesome recreation than cheerful, intelligent conversation. But to become a good conversationalist one must cultivate a variety of interests.

Part of one's leisure time should be spent alone, part with the family, and part with friends. There should be enjoyment in everyday activities, in the family mealtime, and in caring for and improving the home. Hospitality is an activity that can be shared by every member of the family.

A purposeful life. Lack of real purpose causes many people to fail in life. A vagabond is one who starts on a journey without an objective or purpose. To arrive at a destination, one needs to know exactly where one wants to go.

Whenever perplexing questions arise, advice and help should be sought from parents, teachers, or mature friends whose judgment is valued. To read a good book dealing with a particular problem will often give helpful information and restore confidence

In conclusion

IN LEARNING to live creatively in this world of people, each person should make the most of today. He should put his best self into everyday activities and should consciously seek to develop their full possibilities. The ability to find and give pleasure in one's surroundings and daily activities indicates good mental and physical health. A well-rounded life is a daily rhythm in which work, play, rest, and sleep are mutually balanced.

Activities

1. List temptations which young people must face.
2. List social problems, such as employment, about which high school boys and girls should be informed.
3. Chart, for a week, the use made of leisure time by your father, your mother, some older person, yourself.
4. What does your school do to encourage in its pupils the development of skill in creative arts? In the acquiring of hobbies?
5. Make a list of desirable hobbies. Make a list of interesting hobbies you would recommend to one who has few interests.

6. Contemplate your own life. In what ways are you striving to develop your mind? In what particulars have you allowed a quest for pleasure to interfere with your greater aim?

7. Observe and report examples of wishful thinking.

8. Make two lists of mental qualities or traits—the first including healthful, desirable ones; the second, undesirable ones.

9. Discuss the difficulties of developing friendships in your school.

10. Analyze your method of making friends. Outline what happened when you may have lost a friend.

11. Name emotional traits that tend to limit one's friendships.

12. Select some character from history and analyze his personality.

13. Budget your time in advance for a week and try to keep to the schedule. Note the effect on accomplishment.

14. Give examples of men and women who by individual initiative and responsibility have triumphed over serious handicaps. Make a list from history and literature.

Test

Directions: Below is a list of twenty characteristics which affect behavior in the major activities of living. On a separate piece of paper write the numbers from 1 to 20. After each number write the letter corresponding to the activity which you think may be influenced by this characteristic. State the reason for your choice based upon evidence derived from this book. Do not write in the book.

A, participating in a happy home life
B, achieving success in school work
C, achieving success in business

1. appreciation of beauty
2. adaptability
3. courtesy
4. co-operation
5. courage
6. generosity
7. good health
8. industry
9. initiative
10. judgment
11. loyalty
12. neatness
13. punctuality
14. responsibility
15. self-control
16. sympathy
17. sociability
18. service to society
19. tact
20. thrift

25. *MANY DISEASES CAN NOW BE CONTROLLED*

HAVE you ever heard of a person who carried a horse chestnut in his pocket to prevent rheumatism or who wore a sack of camphor around his neck to drive away influenza? Such notions can be traced back to the belief that, during disease, demons invade the body. For many centuries superstition, tradition, and ignorance have been obstacles in the path toward the banishment of disease.

Scientific study of the nature of disease began less than a century ago. Since then, rapid strides have been made toward an understanding of disease. We now know that many communicable diseases can be prevented and that some can be almost eliminated. Their existence often represents the failure of some person or persons to observe the laws of healthful living. Every person should know the conditions in his environment that are harmful and the steps that should be taken for protection. This fact is becoming associated with a responsibility on the part of the community to enforce quarantine and to provide vaccines and antiserums.

Do you know . . .

1. What germs are?
2. How bacteria cause disease?
3. How communicable diseases pass from one person to another?
4. How we may protect ourselves against disease?
5. How the body resists disease?
6. What conditions favor the growth of bacteria?
7. How toxin differs from antitoxin?
8. What is meant by the incubation period of a germ disease?
9. What a filterable virus is?
10. What is meant by quarantine? By isolation? By disinfection?
11. How scientific research has helped man in fighting disease?
12. What antibodies are?
13. What natural immunity is?
14. How immunity may be acquired?
15. How resistance to disease may be lowered?
16. When a person is a "disease carrier"?

The nature of communicable diseases. In a previous chapter degenerative diseases were considered; in this chapter communicable diseases will be discussed. These are caused by germs that are acquired directly or indirectly from diseased persons or animals. The term *germ* is applied either to microscopic plants (bacteria), microscopic animals (protozoa), or filterable viruses that cause disease.

Bacteria exist everywhere and multiply rapidly under certain conditions of food, warmth, moisture, and absence of light. Fortunately for us, only a very small proportion of the existing bacteria are harmful. If disease-producing bacteria gain entrance into the body, they may grow and multiply, throwing off substances called *toxins* which act as poisons on the cells of the living body, or producing enzymes which may irritate or destroy body tissues.

It has not yet been possible to isolate germs for all the communicable diseases. Some of the diseases in which a specific bacterium has been isolated are tuberculosis, diphtheria, scarlet fever, typhoid fever, pneumonia, meningitis, dysentery, and septic sore throat. Malaria and amebic dysentery are caused by protozoa. The common cold, influenza, smallpox, chicken pox, and measles are believed to be caused by what are known as filterable viruses.

Viruses are so small that they will pass through filters having such fine pores that no other form of life can go through them. They are sometimes called *filter-passing viruses*. By special microscopic methods suspensions of some of the viruses can be shown to consist of extremely tiny particles. These particles can be kept alive outside the body, but they do not form visible colonies as bacteria do. Their presence is determined by their ability to cause disease either in man or in experimental animals. Some investigators believe that the viruses consist of single large molecules that may be the missing link between lifeless chemicals and the simplest forms of living things. Diseases in which the viruses may be seen under the microscope are rabies and yellow fever.

Infection. Disease-producing germs may be found in the secretions of the nose and throat, in the excretion of the kidneys and

Courtesy Hilton Hotels Corporation

GUEST ROOM glasses in many hotels are sanitized by exposure to ultraviolet lamps, which provide radiation to the glasses, the wrappers, and the operator. Food industries and restaurants are using new developments of science to destroy bacteria and to prevent the spread of disease.

intestines, in the pus or matter of infected sores, or on articles soiled with such discharges. The germs gain access to the body of another person through the openings of the body, such as the nose and the mouth with food and drink or in breathing, or through breaks in the skin and mucous membranes, such as cuts, abrasions, and the bites of insects. Through coughing, sneezing, kissing, spitting, or promiscuous sharing of food, germs often pass in the mouth fluids directly from one person to another.

Courtesy Bausch and Lomb Optical Company

TUBERCLE BACILLI from sputum of a person with tuberculosis of the lungs look like this when magnified 1,800 times.

Cleanliness is absolutely essential in preventing the contamination of food and water. Broken skin should be treated with an antiseptic to stop the growth of any germs that might enter. Tincture of iodine is recommended for this purpose (see p. 469). Sunlight will soon kill most disease germs on surfaces exposed to it.

Period of incubation. This is the period intervening between the moment when the disease germs enter the body and the time when the patient begins to feel ill. The time required for the germ to grow and to develop poisons varies according to the disease, but it is usually between two to three days and two or three weeks.

Period of communicability. A disease is communicable as long as the germs are present in the discharges of the body, in open sores that harbor them, or in the scales of infected skin.

Methods of control. Germ diseases may be controlled by preventing the germs from leaving the sickroom and "hitchhiking" to someone else. This sometimes involves destroying the germs which cause the disease. In diseases involving the respiratory and digestive tracts, the following precautions should be observed:

Dishes used by the sick person should be boiled after each meal and kept separate from those of the rest of the family.

The discharges from the nose and mouth should be deposited in paper handkerchiefs which can be burned.

Excreta of typhoid patients should be placed in a covered vessel and disinfected with a chemical such as formaldehyde, chloride of lime, or unslaked lime.

All bed linen and undergarments of those suffering from diseases of the respiratory and intestinal tract should be boiled for at least twenty minutes.

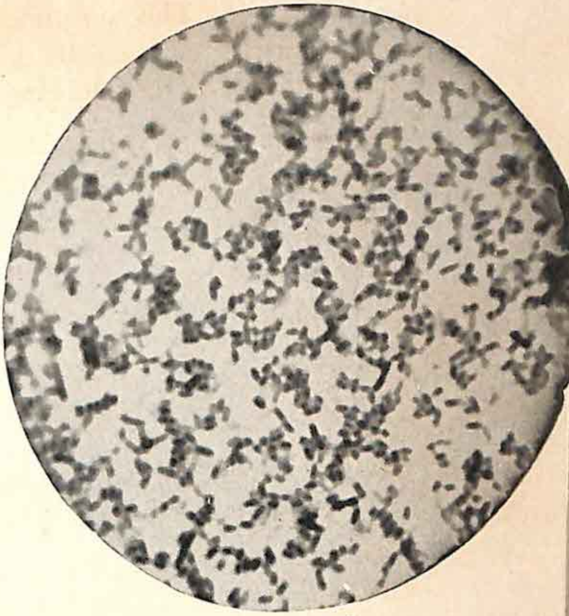
Persons suffering from communicable diseases should be isolated until the danger of infection is past.

Quarantine. Persons who have been exposed to a communicable disease to which they are not immune (see p. 388) should be quarantined or kept apart from other persons until the incubation period is over. Selective quarantine is often used. For example, a child exposed to mumps, which has a long incubation period (three weeks), may be allowed to attend school until a few days before the disease is expected to develop.

Carriers. Sometimes an individual may harbor germs of diphtheria or typhoid fever without knowing it and may be a carrier of the disease. That is, while he may not be affected himself, he is capable of passing the germs on to others. Such a person should be isolated as long as he is a menace to the health of others, unless the transfer of the disease can be controlled by certain precautions. For example, a typhoid carrier must not handle food, cook, or act as a waiter.

Isolation. This means separating a carrier or a person sick with a communicable disease from all other individuals, except the nurse and the physician, in and outside of the home, until the danger of contagion is past. If the patient is cared for in the home (see p. 476), he should be placed in a separate room which no one but the person who is caring for him is allowed to enter. He should have his own dishes, toilet articles, and other equipment. Physicians and nurses in such cases take special precautions against carrying the disease to others.

Safeguards. Barriers against the entrance of germs into the body are a clean, unbroken skin, the hairs in the nose, the saliva of the mouth, and the fluid in the eyes. The mucous membrane lining the nose, mouth, and throat often catches the germs and prevents them from going farther into the body. The white blood cells or corpuscles form the standing army that is ready at all times to develop and destroy the invading germs. All these body defenses, however, may be weakened through unhealthful living.

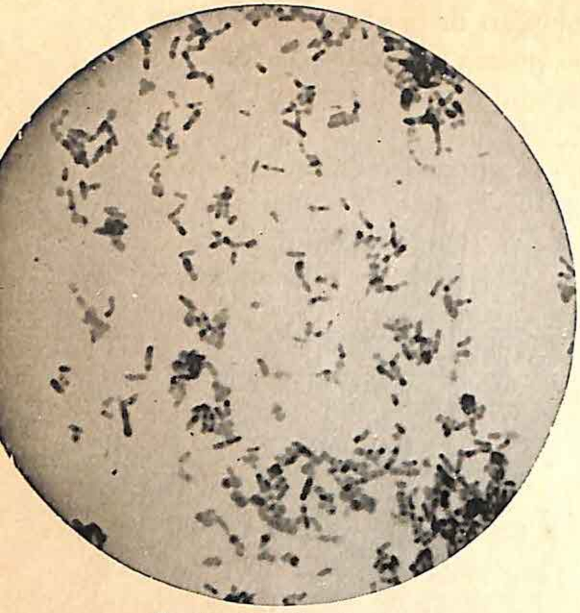


Courtesy Bausch and Lomb Optical Company

TYPHOID BACILLI, the growth of which produces typhoid fever, appear like this under a microscope when magnified 1,800 times. Typhoid fever may become epidemic through polluted water, milk, or raw food.

Antibodies. Besides the standing army of white corpuscles, antibodies, which protect the body against disease, are formed in the blood. One type of antibody found in the plasma includes the various antitoxins which neutralize the toxins of certain disease-producing bacteria. Other antibodies, known as *agglutinins* and *opsonins,* develop in the blood and aid the white corpuscles in destroying the disease germs. Agglutinins affect the movement of the bacteria and clump them together so that the white corpuscles may consume them more easily. Opsonins in some way prepare the bacteria so that they are more readily attacked by the white corpuscles.

Natural immunity. The ability of the body to resist disease is called *immunity*. Natural immunity is an immunity which exists at birth and continues throughout the life of the individual. One



Courtesy Bausch and Lomb Optical Company

DIPHTHERIA BACILLI when magnified 1,800 times show the clublike enlargement at one end of each rod. Antitoxin is injected into the blood for the treatment of diphtheria.

individual may possess more immunity against a given disease than another individual. One member of a family may contract mumps, while other members of the same family may nurse the sufferer without contracting the disease.

Acquired immunity. This is an important factor in the control of disease. In this country certain diseases, such as measles and diphtheria, are diseases of childhood and are seldom contracted by adults. This is probably because most adults have had such diseases in childhood or have been vaccinated against them. To a greater or less degree the blood contains antibodies for many diseases to which the person has been exposed. It is supposed that these antibodies result from the reaction of the body cells to the attacks of diseases which the body was able to overcome. Fortunately, it is not always necessary for the individual to be attacked by a disease in order to acquire immunity against it. Immunity may also be acquired by vaccination or inoculation with dead germs of the disease or with their toxins. By these methods the cells of the body are stimulated to produce additional quantities of antitoxin or other antibodies. This is done by introducing the toxin in small successive amounts, or in a weakened form, into the body, and similarly by introducing dead germs or living but weakened germs. The methods vary for different diseases. Immunity may also be acquired by the use of immune serums, including antitoxins (see pp. 391 and 396), derived from immune persons or animals. This acquired immunity may last from a few days to many years or in some cases as long as one lives, depending upon the disease and other factors. In some diseases, as the common cold, no immunity may be gained by an attack.

Immunity and healthful living. Individual resistance is lowered through improper food, through fatigue, and through chilling from exposure. Living in overcrowded, insanitary surroundings weakens the body. A recent attack of a disease lowers the vitality of the body and often makes one more susceptible to other diseases.

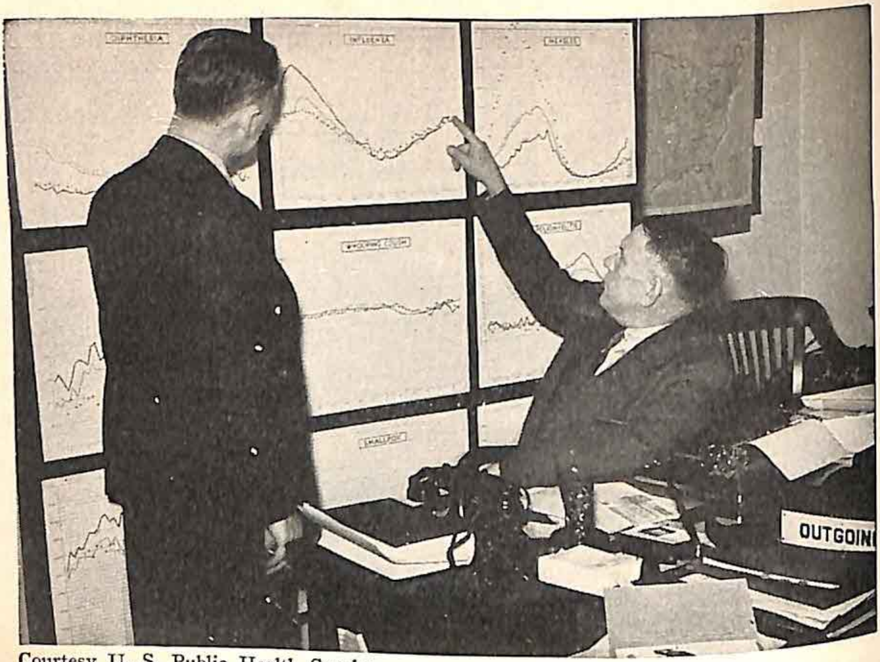
SMALLPOX

Do you know . . .

1. *Why smallpox is no longer a greatly dreaded disease?*
2. *How vaccination was discovered?*
3. *What vaccine is?*
4. *How vaccination prevents smallpox?*
5. *If vaccination is dangerous?*
6. *How smallpox can be wiped out?*
7. *How smallpox epidemics start?*

A scourge in the Middle Ages. Smallpox is a very old disease which existed in ancient China and was common in Europe in the Middle Ages. As far as definite records are available, the indications are that as late as 1750 a large proportion of the people of Europe contracted smallpox, one-tenth of those attacked died, and very many of those attacked were disfigured for life. One-eighth of the blindness was due to smallpox.

Smallpox was introduced into America by a Negro slave who accompanied Cortez to Mexico in 1519. The Indians were easy victims of the disease. It is estimated that there were about 12,000,000 Indians in this western hemisphere and that 6,000,000 of them died of smallpox. Today, scarred and pock-marked faces are to be seen everywhere throughout Mexico and South America,



Courtesy U. S. Public Health Service

THESE CHARTS are prepared in Washington from telegraphic reports received weekly from stations throughout the country. The graphs show the trend of communicable diseases.

countries in which vaccination is not systematically practiced.

It is estimated that during the 1700's the number of deaths from smallpox was about 2,000 per 100,000 persons. In Europe, United States, and Canada at the present time, because of vaccination, the death rate is less than one per 100,000. The victory over smallpox was the first great achievement of modern medicine. This is an example of disease control in which the disease is prevented by making the individual immune to the disease.

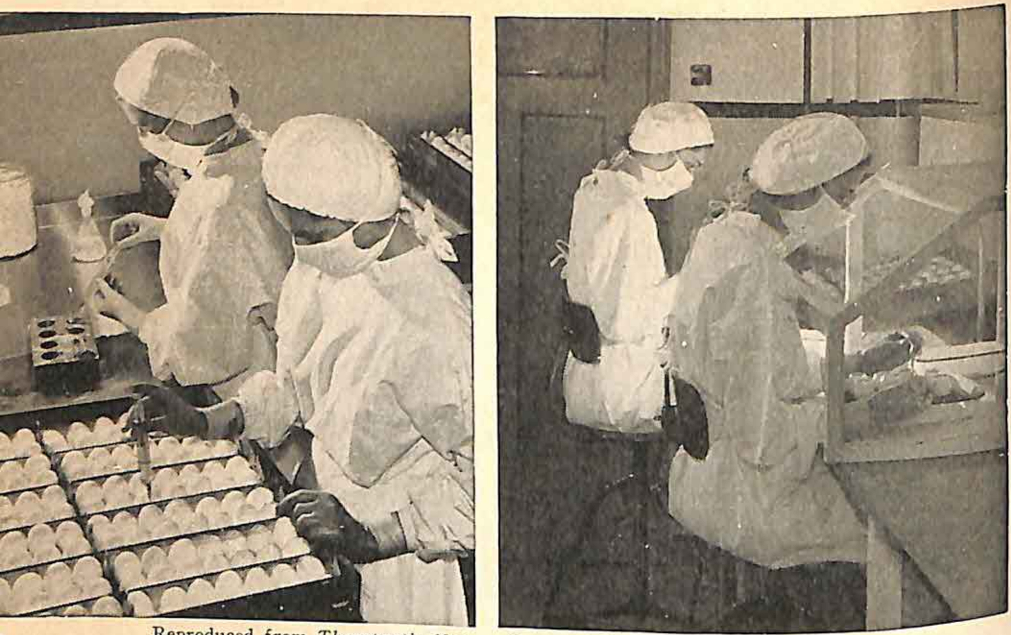
The nature of smallpox. Smallpox is not a filth disease as has been generally believed. It attacks all ages and all classes of people —the clean and the unclean, the rich and the poor. The cause of the disease is a filterable virus which may be demonstrated in the discharges of the nose and mouth and pustules on the skin of the patient. Droplets from the nose and mouth spread the disease from person to person, and so do pus and scales from the skin, as well as clothing or other articles contaminated by the sick person.

During the disease a general "breaking out" appears over the surface of the body, and this is followed by more or less pitting (depressed scars) of the skin, especially of the face and hands. If these pockmarks are very deep, they persist throughout life. No specific remedy is available for the treatment of smallpox after it has once been contracted. Recovery from an attack generally results in lifelong immunity. Through vaccination, immunity is possible for all.

Discovery of vaccination. Vaccination was established by Edward Jenner, an English physician. He found that among the country folk of a certain section of England there was a tradition that if one had had cowpox he could not take smallpox. It was claimed that if while milking, for instance, one got matter or pus into a sore from a pustule of a cow that had cowpox, one would be immune to the dreaded smallpox. In 1796, Jenner transferred to the arm of an eight-year-old boy the matter from a milkmaid's hand which had been scratched by a thorn and later accidentally inoculated with cowpox. A typical "take" followed. Two months later, Jenner inoculated the same boy with matter from a smallpox patient, and no symptoms of this disease appeared. At first Jenner met with much opposition, but gradually the value of cowpox vaccination against smallpox was recognized and its practice spread over the entire world.

Vaccine. Smallpox vaccine (from Latin *vacca,* cow) is prepared by inoculating healthy calves with cowpox virus. The calves are kept in the most sanitary surroundings. When pustules appear, they are removed, ground very finely, mixed with dilute glycerine and special antiseptics, and placed in a sterile bottle. After a few weeks the liquid is tested carefully. If found to be free from living bacteria, it is put in sealed tubes ready for distribution. Recent experimentation has produced bacteria-free vaccine by inoculating a two-day-old chick embryo with cowpox virus. This method may some day replace the use of calf virus.

Vaccination. The method most commonly used is to rub a small amount of vaccine into a scratch in the outer layer of skin



Reproduced from *Therapeutic Notes.* Courtesy Parke, Davis and Company

IN THE PREPARATION of absolutely sterile vaccines, chick embryos are used. The organism causing typhus fever, a disease transmitted by the bite of infected fleas and lice, can be grown in chick embryos in the laboratory. In the picture on the left, technicians are injecting a suitable dose of virulent typhus organisms into the yolk sac of the growing chick embryo. When the egg culture is ready to be harvested, this very dangerous operation is performed under individual glass hoods, shown at the right. The material containing the organisms, which are then killed, is filtered. The resulting vaccine is tested on animals to determine its potency.

of the arm or leg. If the person is not immune to smallpox, a single pustule forms at the point of inoculation. This pustule goes through various changes for about three weeks, at which time the scab comes off, leaving a scar.

The arm should be kept free from contamination while the vaccination is moist. When dry, no dressing is needed. If the pustule is broken, it should be covered with a layer of gauze fastened to the arm by strips of adhesive tape placed to either side of the pustule. Vaccination on the leg is not always advisable, since the spot is easily contaminated by dust from the street and is more subject to irritation from exercise than vaccination on the arm near the shoulder. The left arm is generally selected, but if one is left-handed the right arm should be vaccinated. Immunity is absolute for an average period of about seven years after a successful vaccination.

The duty of every citizen. Since vaccination is no longer dangerous and does prevent smallpox, everyone should be vaccinated. Vaccination causes less discomfort to infants than it does to older children. It should be performed before the child is one year old. In protection from smallpox, a good vaccination scar is a badge of good citizenship. Smallpox continues to exist because of the unvaccinated. There is no compulsory vaccination law for the United States as a whole, and in only fourteen states are children compelled to be vaccinated before going to school. But to advocate and support vaccination is a national obligation which falls on all. Smallpox would practically be eliminated if vaccination were made universally compulsory.

DIPHTHERIA

Do you know . . .

1. *What diphtheria is?*
2. *What the Schick test is?*
3. *How one can be protected against diphtheria?*
4. *How the antitoxin for diphtheria is prepared?*
5. *How diphtheria is spread from a sick person to a well person?*
6. *How a diphtheria culture is made?*
7. *How toxoid differs from toxin-antitoxin?*
8. *Why diphtheria may be regarded as a vanishing disease?*

The epidemic at Nome. Nome, Alaska, was stricken with diphtheria in January, 1925. In one night twenty-three people—mostly Eskimo children—became sick, and in a few days five of them died. The limited supply of antitoxin serum was exhausted almost at once. The nearest railroad point was 655 miles away. The ice prevented boats from reaching Nome, and airplanes tried to reach the city but failed. Only relays of dog teams could be depended on to bring the serum along the frozen shores of Bering Sea.

Eight experienced drivers undertook the task. Relaying each other with teams of the best dogs in Alaska, these men fought their way through blinding clouds of snow, waist-deep drifts, and over high crags of ice. They made the trip in five and one-half days instead of the usual nine days.

The final stretch from Bluff to Nome was made by Gunnar Kasson and his dogs. Kasson had to depend entirely on his lead dog, Balto, who was able to scent the trail through the snow and over the ice. When they reached Nome, early in the morning of February 2, 1925, both Kasson and his dogs were half frozen, but the twenty-pound package containing 300,000 units of life-saving antitoxin was safe.

A disease of childhood. Diphtheria attacks chiefly young children. It becomes less common after the tenth year of life. The disease is caused by rod-shaped bacteria (diphtheria bacilli) growing on the mucous membrane of the mouth, nose, throat, or eye (usually the throat), or occasionally in a break in the skin. As the growth of bacteria increases, a tough gray membrane spreads over the infected area. The first symptoms of a diphtheria throat resemble those of a mild sore throat. Every sore throat and croupy cough should be investigated by a competent physician. Diphtheria is spread by means of droplets thrown out in coughing, sneezing, or even in speaking. Objects, such as toys, handkerchiefs, food, and spoons, which come in contact with fresh secretions from the infected areas may carry the disease.

A diphtheria culture. Whenever diphtheria is suspected, a culture is made from the secretions of the throat or from whatever area is suspected. To do this a sterile cotton swab is passed over the infected area. The swab is then passed over the surface of a special culture medium in a sterile test tube. The box is placed in an incubator where it is kept at body heat for from twelve to twenty hours. The bacteria multiply rapidly and are readily recognized under the microscope. If diphtheria germs are found, the culture is said to be positive; otherwise it is negative. The culture method is also used to recognize diphtheria carriers.

Courtesy Parke, Davis and Company

TO PREPARE toxins, it is necessary to isolate the desired kinds of bacteria. This is done by transferring bacterial colonies on a sterile needle from the Petri dish, in which they are first grown, to a test tube containing beef broth or other culture medium.

Diphtheria carriers are persons who are immune to diphtheria but who carry the germs in the nose and throat without having the disease. Hence they are a menace to others.

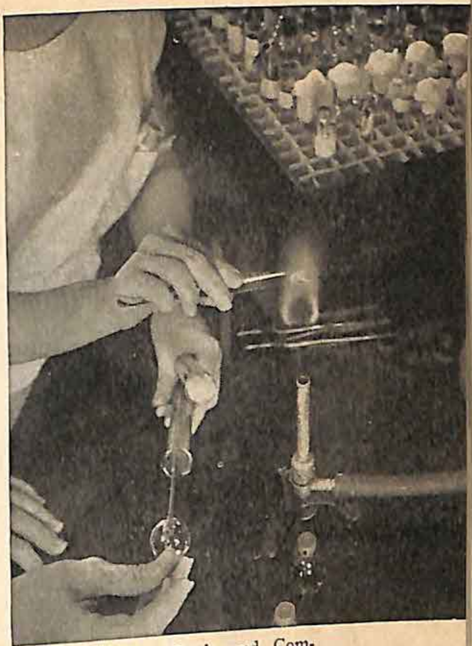
Isolation and quarantine. A patient with diphtheria should be isolated until three cultures, taken not less than twenty-four hours apart, are all found to be negative. No one but the person assigned to take care of the patient should be allowed in the sickroom. Other children in the home who have been exposed should have a Schick test, should be given an immunizing injection of antitoxin if they are not immune, and should, if possible, be sent to the home of relatives or friends who have no children. All exposed persons should be quarantined until cultures show that they are neither ill nor carriers. The incubation period is usually two to five days, but may be longer. Placarding the house with the word "diphtheria" is important as a warning to others. In large cities, and indeed in many of moderate size, diphtheria patients are removed from the home and are isolated in a special hospital.

Diphtheria toxin. Diphtheria bacilli grow readily in beef broth. As they increase in number, they secrete toxin. The broth is filtered through an unglazed porcelain filter. The filtrate, or the liquid that passes through the filter, contains diphtheria toxin but no bacilli. This toxin is used to develop antitoxin in the bodies of animals and to make toxin-antitoxin and toxoid, a more recent preparation for protection against the disease.

Antitoxin. This is usually obtained from the blood of a horse that has been immunized against diphtheria. To develop the antitoxin, the horse is injected with a small dose of diphtheria toxin or a larger dose of toxin-antitoxin. The doses are gradually increased in size and given at intervals of from five to seven days. After the horse has become highly immunized, blood is removed and allowed to clot. The yellow fluid left after removal of the clot is the serum and contains the antitoxin. This serum is treated with chemicals to precipitate out the antitoxin which is next put in solution. It is then carefully tested for freedom from bacteria and as to its antitoxin strength, and is kept in sterile bottles before being put into sterile glass syringes or other containers ready for use. These containers are marked by the number of units per cubic centimeter, indicating the relative strength or degree of concentration.

The use of antitoxin in the treatment of diphtheria began in 1893. Before that, 30 to 50 percent of all who contracted diphtheria had died. Since that time there has been a steady decline in the number of deaths due to diphtheria. The antitoxin is injected into a muscle or, in severe cases, into both a muscle and a vein. Treatment should be begun as soon as possible after the disease is discovered (often without waiting for a report on the test culture), since the antitoxin has less effect the longer the disease has run. The reason for this is that, while the antitoxin neutralizes the toxin as it is produced by the bacteria, it can do little to overcome toxin which has already combined with nerve tissue.

Schick test. In 1913, a test for determining whether or not a person is immune to diphtheria was discovered by Dr. Bela Schick of Vienna. A small dose of the diphtheria toxin is injected into the skin, usually of the forearm. If the child is immune, nothing happens, because the antitoxin in the blood counteracts the poison. This is known as a negative reaction to the Schick test. If the child is not immune, a red spot appears within four or five days at the point of the injection, varying in size according to the severity of the reaction. This is known as a positive reaction, and it indicates that artificial immunization is necessary.



Courtesy Parke, Davis and Company

UNDER COMPLETELY aseptic conditions, samples of finished biological materials are transferred from containers to culture tubes, which are then placed in the incubator and observed for development of live bacteria.

Toxin-antitoxin. Artificial immunity to diphtheria for several years and perhaps even for life is developed by inoculation with toxin-antitoxin. This is a neutral mixture of diphtheria toxin with antitoxin, given by injection under the skin of the arm. Three doses are given at intervals of a week and repeated if necessary until the child becomes Schick-negative. Since young children are most apt to contract diphtheria, the toxin-antitoxin treatment for this disease should be given before the child enters school.

Six months after toxin-antitoxin treatment, the Schick test is given again. If the reaction is positive, another series of injections for immunization is recommended. About 95 percent of the number immunized for the first time show that they are protected.

Toxoid. A substitute for toxin-antitoxin called *toxoid,* is now generally used. In treatment with toxoid, usually only two injections are necessary, as immunity is developed more quickly. Diphtheria toxoid is toxin to which formaldehyde has been added so that it is no longer toxic. It may be purified by precipitation with alum. Toxoid is said to produce a more effective immunity to diphtheria than does toxin-antitoxin and avoids the risk of making the child sensitive to horse serum.

Effect of immunization. During the greater part of the 1800's, diphtheria was the most dreaded disease of childhood. It is still a dangerous disease. The number of cases and the number of deaths, however, have greatly diminished since the antitoxin treatment began. The Schick test for immunity and the use of toxin-antitoxin or toxoid to immunize those likely to contract the disease have reduced the death rate almost to the vanishing point in certain localities. A number of our large cities have not had a single diphtheria death in several years. This should be possible in all communities. Whether diphtheria shall continue to terrify depends on the intelligent co-operation of every member of the community.

TYPHOID FEVER

Do you know . . .

1. What is the cause of typhoid fever?
2. How typhoid fever is contracted?
3. How food and water become polluted?
4. When and where typhoid may be encountered?
5. What precautions should be taken to avoid typhoid fever?
6. If typhoid fever can be eradicated?
7. What typhoid carriers are?

A vanishing disease. In 1950 the death rate from typhoid fever was 0.1 per 100,000, a decline from 22.8 in 1911. To a great extent, however, typhoid fever is under control in large cities. This relative disappearance of typhoid from large cities has been brought about through sanitary regulations that provide for pure water supplies, the pasteurization of milk, and the prevention of contamination of food.

A disease of the small town. The low typhoid rates of larger cities are not found in rural areas. In the 1930's in sixty towns of from 500 to 1,000 population there was a typhoid case rate of 44.3 per 100,000 population, as compared with the lower rate of 6.3 per

100,000 population in cities of 25,000 or more population. The small town with its lack of modern sanitation remains the focus of typhoid in the United States. The small town is often the destination of the vacationist who may either catch or spread the disease.

Its nature and channels of infection. Typhoid fever is due to certain bacteria (bacilli) that grow in the intestines of the patient and are found in the discharges from the body. By contaminated sewage, drinking water is often polluted. Flies, if allowed access to the sewage, collect germs on their feet and bodies and bring contamination to food that has not been properly protected.

Typhoid bacilli enter the digestive tract through polluted food and water. Typhoid has been reported as a result of using infected milk, of drinking water from polluted wells, or of swallowing contaminated water in bathing pools, at crowded beaches, and in small lakes. Raw food, such as oysters grown where they come in contact with sewage, or celery and lettuce washed in polluted water, may cause typhoid fever. Serious outbreaks have been traced to cooks or voluntary helpers who carried typhoid germs on their unclean hands.

A safeguard. Immunity may be secured through vaccination. The vaccine for typhoid consists of the dead typhoid bacteria, and is administered three times with intervals of one week between inoculations. This usually protects one from typhoid infection for three or more years. If a person is likely to be exposed to paratyphoid bacteria, which produce a disease similar to typhoid fever, a combination vaccine of typhoid and paratyphoid bacteria is given. In previous wars—for example, the Spanish American War—there had been a very serious death rate from typhoid fever. But in World War I those of our nurses and soldiers who were sent abroad were given typhoid-paratyphoid vaccine, with the result that the death rate from typhoid and paratyphoid fevers was negligible.

Carriers. Typhoid carriers probably constitute the greatest obstacle in the complete eradication of the disease. Certain people, who are apparently healthy, carry typhoid bacteria and cause many cases of typhoid fever each year through the handling of food with unwashed hands. Other cases may result from personal contact with these carriers. Carriers must be prevented from handling food which is to be used by others.

A safe vacation. In arranging for a vacation, even for a day, a place should be selected where the drinking water and milk supply are unquestionably pure. The water should be protected against contamination due to faulty drainage, and the milk should come from clean barns and be carefully handled. If there is even the slightest doubt as to the purity of these supplies, they should be "sterilized" by boiling. Kitchens and dining-rooms should be properly screened to protect food from flies. Always keep in mind the important part played by flies in the spread of typhoid and other infections involving the digestive tract.

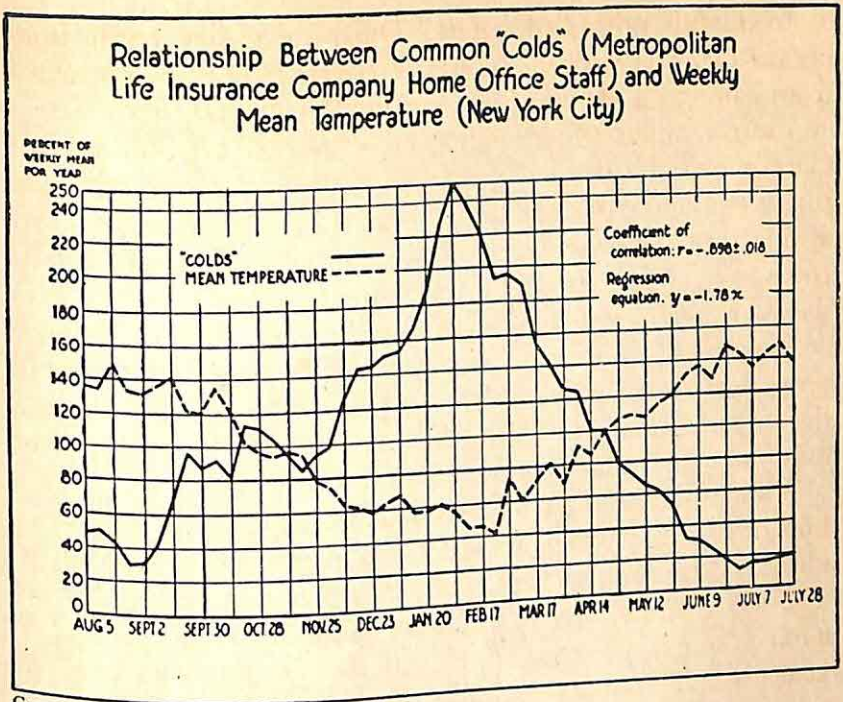
While camping, it is always best to boil the water unless it is known to be free from contamination (see p. 425). Clear, sparkling spring water may be polluted by underground drainage. The water supply should be carefully considered in deciding on a tourist camp. Chlorine tablets, if obtainable, can be carried conveniently and used to purify water for drinking purposes. Lastly, vaccination against typhoid is recommended for all vacation travelers.

THE COMMON COLD

Do you know . . .

1. What the cause of colds is?
2. Why colds are thought to be contagious?
3. Under what conditions colds develop?
4. Why a person who has a cold is a menace to others?
5. Why neglecting a cold may become a serious matter?
6. What the personal responsibility is of one who has a cold?
7. In what ways colds can be prevented?
8. How influenza differs from the common cold?

"Our common enemy." More time is lost from work and school because of colds than because of any other disease. In school, not only does a pupil get behind in his own work because


Relationship Between Common "Colds" (Metropolitan Life Insurance Company Home Office Staff) and Weekly Mean Temperature (New York City)

Courtesy Metropolitan Life Insurance Co.

ACCORDING to this chart "colds" are most prevalent in late winter, when the temperatures are the lowest, and least prevalent in midsummer.

of absence, but the whole class is sometimes retarded through the absence of several members who have colds. In the United States the average loss of time from colds is from one to three days a year for each worker.

Almost everyone has a cold at least once or twice a year, and some persons have a continuous cold. It has been estimated that 60 percent of the people of the United States have three or more colds a year. There are persons who are definitely susceptible to colds. Office workers have nine times as many colds as taxi drivers. Temperature changes seem to have a great influence on the existence of colds. Colds occur most frequently in the late winter and early spring and occur least frequently in the sunshiny months of summer. It is an interesting fact that many people complain of catching cold from exposure to the temperature contrasts associated with air conditioning in hot weather.

Fewer colds occur in summer, perhaps because people spend more time out-of-doors, thus hardening the respiratory tract by mild exposure, partly because of the beneficial effects of ultraviolet light, and partly perhaps because they eat more vegetables which contain vitamins.

Investigations as to the cause of colds. Research has differed as to the specific cause of colds. Some investigators have blamed the bacteria found in the upper respiratory tract, while others have attacked the problem on the assumption that a cold is caused by a filterable virus, i.e., something which passes through the Berkefeld porcelain filter. The "filterable virus" theory of the common cold is now generally accepted. Streptococcus and other bacteria often act as secondary agents in the common cold and cause many of the complications which follow.

There has been a great deal of difference of opinion as to whether the infecting agent of the common cold needs to be set in action by other disturbing factors, such as fatigue, general or local chilling, wet feet, an emotional upset, or lack of vitamins in the body. The cold may be in large part a symptom of a generally disordered condition of the body.

Prevention of colds. Since there is no agreement as to the importance of secondary infective organisms in the common cold, no specific remedy can be prescribed. Among the numerous more or less scientific methods of prevention may be mentioned vaccines, ultraviolet rays, chlorine, and diet.

Much work has been done in preparing vaccines for the treatment of colds. Some of these vaccines may help to minimize and prevent secondary complications. Most doctors agree that up to the present time no single uniformly effective vaccine has been developed. Now that the filterable virus causing colds has been discovered, some effective treatment will no doubt be devised.

An adequate diet usually contains all the vitamins that the body needs. There is little or no evidence that one can ward off colds by adding more vitamin A and D to the diet.

It is probable that the frequency of colds may be reduced through rest, diet, sun baths, and preventive inoculation with bacteria often present in the common cold as secondary invaders.

But it is more important for anyone who shows even a trace of fever to remain at home.

Caring for a cold. In the care of a cold everything should be done to make the patient as comfortable as possible, to prevent complications, and to minimize or stop the spread of the disease.

It is agreed that we are more susceptible to colds when the vitality is lowered through fatigue and overeating; so rest and the avoidance of fatigue are of first importance in the treatment of a cold. Proper care in the beginning will help to prevent later complications. If there are no complications, four to seven days are required for the disease to run its course.

The person who has a cold should remain in bed to keep the body at an even temperature and should eat lightly. If there is any fever, rest in bed should be continued until at least twenty-four hours after the fever disappears. A laxative should be taken if the bowels are at all sluggish.

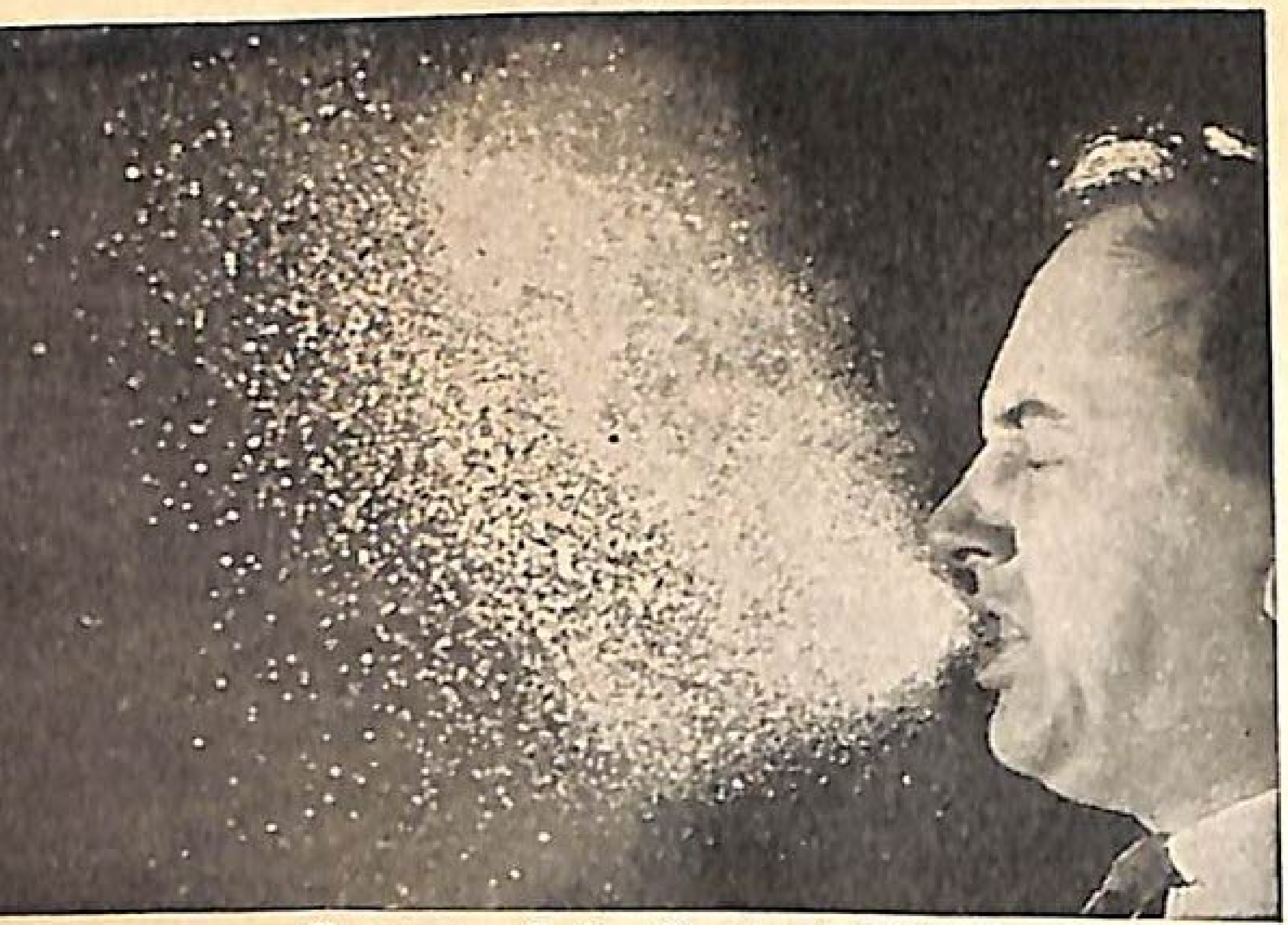
Most persons with a cold are very susceptible to chilling. If a warm or hot bath is taken, great care should be observed not to expose the patient to any chilling after he leaves the bathroom.

Aspirin (acetyl salicylic acid) is frequently used in the treatment of colds. Provided one is not allergic to aspirin, five grains may be taken at stated intervals as prescribed by the physician. It is much safer to call in a physician for treatment of any severe cold, since pneumonia or other complications might develop.

The many patent medicines (see p. 356) advertised to cure colds have little value and are often quite harmful.

As far as possible, persons suffering from colds should be isolated. Everyone with a running nose should remain at home. Those who have colds should be careful not to pass the infection on to others through sneezing, coughing, or kissing. Blowing the nose correctly (see p. 98) is an aid in preventing spread of the infection to the sinuses or the middle ear.

"Just a cold." A person seldom or never dies of a cold, but "just a cold" very often is the start of a fatal pneumonia. Colds do not cause tuberculosis, but they may prepare the ground for rapid growth of a tuberculosis infection. Infection may extend to the cavities in the bones of the front of the skull, called the



Courtesy of the Dept. of Biology and Public Health, Massachusetts Institute of Technology

THIS PHOTOGRAPH, taken under a very short exposure (1/30,000 of a second), shows a cloud of minute droplets from the nose and throat at the climax of a sneeze. The moisture evaporates, leaving many germ-laden particles of matter floating in the air for other people to breathe.

nasal sinuses (see p. 96). This inflammation is called *sinusitis*. In fact it is likely that most colds are accompanied by more or less sinusitis. Many of the chronic ailments of the respiratory tract are indirectly caused by colds.

Influenza, a widespread disease. Influenza, or the "flu," appears in epidemic form at irregular intervals. At intervals of twenty to forty years, great epidemics have spread over the world, being then known as pandemic. In the influenza pandemic of 1918, over a quarter of a million Americans died; and it has been estimated that over the whole world there were 200,000,000 cases of influenza and perhaps as many as 10,000,000 deaths caused by this dread disease. There is some influenza during every winter season.

Not a common cold. The terms "common cold" and "influenza" are often confused. Influenza may start like a cold but develops fever, severe headache and backache, and extreme weakness. The specific cause of influenza is now recognized to be another filterable virus. The secretions of the mouth and nose carry the infectious agent, and the disease is spread by droplet infection, coughing, sneezing, speaking. Unlike many other diseases, one attack does not establish any important degree of immunity. Up to the present time, no satisfactory method of artificial immunization has been discovered.

The death rate from ordinary influenza is low. Where death occurs, it is practically always due to secondary infection. Like the common cold, influenza may drift into bronchitis or pneumonia. On the first suspicion of "flu" it is wise to go to bed, drink freely of fluids—water and lemonade—and remain in bed from two to four days after the temperature remains entirely normal. There are no medicines for the cure of influenza, and so far no vaccine treatment has been found effective. One should be careful not to engage in sharp or prolonged physical exercise too soon after having had influenza.

TUBERCULOSIS

Do you know . . .

1. *Why tuberculosis is so contagious?*
2. *How the body can be protected against tuberculosis?*
3. *Why tuberculosis is sometimes said to be a disease of poverty?*
4. *At what ages tuberculosis is most prevalent?*
5. *If tuberculosis is inherited?*
6. *What the tuberculin test is?*
7. *What the treatment is for tuberculosis?*
8. *Why spitting on floors and sidewalks is forbidden?*
9. *If climate helps in the cure of tuberculosis?*

The great white plague. At the beginning of the 1800's, tuberculosis was responsible for more deaths than any other single disease. Because it was so common and so deadly, it was known as "the great white plague." A death rate of 250 per 100,000 in 1892 was reduced to almost 22 per 100,000 in 1950. The relative suppression of this disease has come about through education of the people in ways of living. During the past twenty-five years tuberculosis has dropped from first to eighth place in the list of causes of death. But although this disease is becoming less of a menace for the entire population in the United States, it is still the leading cause of death of persons between the ages of fifteen and thirty-five years.

A disease of poverty. Although tuberculosis attacks persons in all walks of life, it is most common among the poor. Inadequate food, bad housing, overcrowded living conditions, overwork, and worry lower the resistance of the body and thus contribute greatly to the existence of the disease. The control of tuberculosis is largely an economic problem.

A slowly developing disease. The germ which causes the disease is a bacillus. It is inhaled, contracted from soiled hands, or taken into the mouth with contaminated food and water. It is also frequently contracted by direct exposure to a tuberculous person. Any part of the body may be attacked. In pulmonary tuberculosis (consumption) the germs lodge in the lungs and by their activity produce the characteristic picture of the disease. Little nodules or tubercles develop and poisons are produced. The germs can live for several hours outside of the body in moist sputum but die in a few hours when exposed to direct sunlight. Tuberculosis develops slowly, at least in the earlier stages, and generally over a period of several years. For this reason its existence is often not recognized until it has reached an advanced stage. In the beginning, hygienic living is often sufficient to arrest its development.

Not inherited. Tuberculosis is not inherited, but children of diseased parents may inherit a general weakness which makes them more susceptible than children of healthy parents. After they are born, many children may contract the disease from their parents. Unfavorable environment is the most important predisposing factor. Persons who know that there is a history of tuberculosis in the family should be especially careful to live hygienically.

Infection. Infection may take place whenever germs get into the body. Most people are able to cope successfully with a few tuberculosis germs and the disease may never develop. Examinations show that many adults have lung scars which indicate that infection with tubercle bacillus has been there at some time. If body resistance is lowered, especially in youth, by other illnesses, malnutrition, or over-fatigue, the germs may gain the upper hand and an active case of tuberculosis may result. Unpasteurized milk from infected cows could be a source of infection. The compulsory inspection of dairy herds has practically eradicated this source in human beings. Nowadays, people most frequently acquire tuberculosis from contact with other people who are infected.

The neglected age. The early type of tuberculosis is not often dangerous at the time but may become serious to the adolescent if he does not keep himself in good physical condition. It is in the high school age that the number of cases of tuberculosis increases, and girls are nearly twice as likely to have the disease as boys. The death rate reaches its peak in the years from twenty to twenty-five. Susceptibility to the disease during youth is probably the result of lowered resistance caused by physical changes going on in the rapidly growing body. together with diminished care and supervision of rest and expenditure of energy. Late hours and numerous activities interfere with rest; bad food habits, such as frequenting the soda fountain, and the dieting fad among girls, interfere with good nutrition.

Detection. The tuberculin test is a valuable aid especially in detecting beginning tuberculosis in children. This test shows whether the person is or has been infected with living tubercle germs but it does not prove that he has tuberculosis. The X-ray examination is another excellent help in finding tuberculosis. Enlarged glands and various defects in the lung show up in the X-ray pictures. A doctor can tell whether a person has active tuberculosis only after he has carefully studied all the symptoms and signs.

Prevention. Strong, healthy bodies do not so often become victims of tuberculosis, but anyone may contract the disease when exposed to it, especially while his vitality is below normal. Sometimes a person who looks healthy may have the disease in advanced form; and some apparently healthy persons may succumb to the disease because they lack the protecting substances within their bodies. To avoid tuberculosis, body resistance should be maintained by observing the general rules of health—wholesome food, fresh air, rest, and exercise. Exposure to the disease should be avoided as much as possible. Cleanliness is important, especially in the care and handling of food and milk. Only pasteurized or certified milk should be used.

Treatment. Early recognition of the disease is important. New medicines as well as rest, good food, and fresh air are used for treatment. In some cases surgery is used. Patent-medicine cures for tuberculosis are dangerous because they delay proper treatment. Climate, while often helpful, is not so important a factor in treating the disease as proper care. A tuberculous patient can be cared for in the home if the patient and family have been properly instructed and co-operate in carrying out the instructions. A large proportion of the cases of pulmonary tuberculosis can be cured or arrested.

A community responsibility. The control of tuberculosis is a community problem. Through a well-organized educational campaign, the National Tuberculosis Association aims to wipe out the disease. Victory can come only when the general public is well informed and interested enough to join in the battle, both as individuals and as organized society.

The National Tuberculosis Association. Through education this organization (see p. 452) is doing much to prevent the spread of the disease. It teaches that in the case of pulmonary tuberculosis all the discharges of the nose and throat must be burned, that people having this disease must eat nourishing food and rest a great deal. It emphasizes the need of early treatment, prolonged care, and of following instructions over a long period of time.

Campaigns are conducted in the schools in order to discover any children who have contracted the disease. Parents are given instruction concerning preventive measures, particularly regarding rest, sunshine, and food habits.

OTHER DISEASES OF CHILDHOOD

Do you know . . .

1. Why infantile paralysis is such a dreaded disease?
2. How it differs from other infections of childhood?
3. Why measles, whooping cough, and chicken pox often are not regarded as serious?
4. Why isolation of the patient is often difficult in these diseases?
5. Why children showing symptoms of illness should be kept at home?
6. In what ways scarlet fever resembles diphtheria?
7. At what stage of the disease scarlet fever is contagious?

Courtesy Work Projects Administration

TO OVERCOME the stiffness of the muscles, massage and relaxation are given in the water treatment of infantile paralysis (poliomyelitis).

Infantile paralysis. This disease attacks rich and poor alike under good and under poor sanitary conditions. Most persons are immune to the disease, but some adults and a greater number of children are attacked by it. Franklin D. Roosevelt became its victim in the prime of life. But 95 percent of those attacked are children.

Poliomyelitis, commonly known as infantile paralysis or "polio," is caused by a filterable virus which attacks some of the cells of the spinal cord, destroying the spinal motor nerve path to the muscles. The disease may start with high fever and severe pain, or the symptoms may be so mild that the parent does not observe them until paralysis has appeared. The destruction of the nerve cells in the spinal cord results in paralysis of various muscles, particularly those of the legs, either one or both sides of the body being affected.

How the disease suddenly appears in epidemic form and how it spreads are not understood. Its spread has been checked by quarantine and isolation. As a rule, one attack of the disease means life protection. If there is an epidemic, it is well to call a physician in case of the slightest suspicion. Injections with the blood derivative, gamma globulin, give temporary protection for about five weeks. Experiments with vaccines are very promising. It may be possible soon to produce complete immunity. After paralysis has occurred, massage and special exercises may later do much to enable the patient to overcome the disability caused by paralysis, especially in early life.

Measles and chicken pox. These diseases are very common among children. They are virus diseases and the viruses pass in the discharges of the nose and throat through direct con-

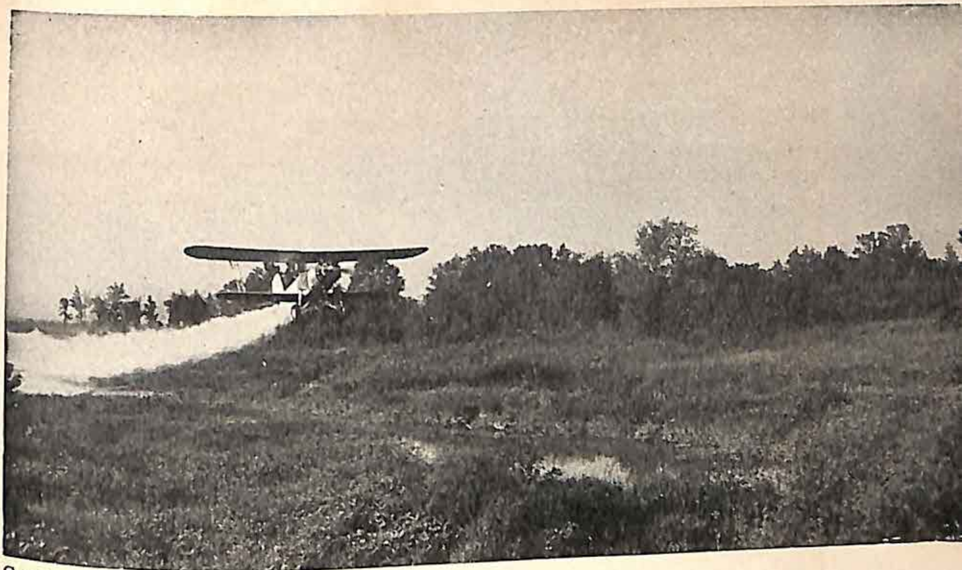
Courtesy U. S. Public Health Service

WORKMEN are filling the pond with truckloads of earth to destroy the breeding places of malaria mosquitoes.

fourth day, according to the particular species of protozoan. Malaria is a serious disease in that it ranks highest among diseases that destroy the health, efficiency, and morale of those who survive its ravages. Immunity does not result from having the disease.

Treatment. There are several drugs which poison the malaria parasite but which, unless given in too large doses will do no permanent damage to the patient. For many years quinine has been the most important. If taken at the right time each dose of quinine decreases the number of parasites until they are often completely destroyed. It may also, as long as it is taken, prevent the development of symptoms of malaria. Quinine comes from the cinchona tree. This tree is native to South America, but about 90 per cent of the world's supply usually comes from the Netherlands East Indies.

When this supply was not available during World War II, scientific laboratories bent every effort to produce quinine synthetically. The effort was successful, but the process is very expensive.



Courtesy U. S. Public Health Service

IN MALARIA CONTROL, over large swampy areas, airplanes are used to spray poison dust.

Thus quinine, natural or synthetic, is still too costly to be available to all who need it. Useful new drugs, among them atabrine and plasmochin, lessen the severity of malaria. The search still goes on for substances that will prevent the disease in man.

Always a menace. The problem of the control and treatment of malaria is one which requires constant attention. It has assumed more serious proportions as a result of the recent war in which great numbers of American soldiers were stationed in tropical or sub-tropical regions, where they were exposed to it. With the return of these men to their homes, extra precautions are necessary to prevent the spread of malaria in this country.

In conclusion

INDIVIDUAL resistance is increased by exercise, fresh air, good food, and rest. These are important measures for the maintenance of health, but they do not afford protection against communicable diseases. An athletic youngster in the best of health may be just as susceptible to measles, smallpox, or scarlet fever as is his friend who is less vigorous. Resistance to communicable diseases depends upon

Courtesy U. S. Public Health Service

A BLOOD SMEAR is being taken for analysis in the laboratory to determine whether or not malaria parasites are present in this person's blood.

the presence in the body of protective substances called *antibodies*. The body may manufacture these, or they may be brought to the body from some other person or from an animal in which they have been produced artificially.

Artificial immunization is one of the most valuable preventive measures contributed by science. Protection by vaccination or serum injections against many dreaded diseases is now possible. It may be that in the future effective vaccines will become available against such diseases as influenza, pneumonia, the common cold, and infantile paralysis.

Actual practice in combating disease must keep pace with the knowledge concerning these diseases. Danger lies in the fact that, as the hazards of the disease grow less, people grow careless and do not protect themselves by immunization against the enemy which may appear at any time. Improvement has resulted from better sanitation, more complete knowledge of the nature of diseases, wider use of methods of prevention, and better care of patients.

Activities

1. Discover the presence of bacteria in air. Obtain three Petri dishes containing sterile agar. Keep one closed as a control throughout the experiment. Uncover and expose one dish at the level of the desk for ten minutes; expose the other on the floor while someone is walking about and stirring up the dust. Keep the dishes in a dark place at room temperature for 48 hours. Wherever a bacterium or a group of bacteria falls on the agar, a colony forms. Compare the colonies in the dishes as to number, color, size, and shape. Describe any molds found to be present. What reasons are there for believing that few of these organisms may produce disease?

2. Make a survey of the class to find out how many have been immunized against smallpox, diphtheria, scarlet fever, or typhoid. How many immunized pupils contracted the disease after being immunized?

3. Make a study in the laboratory of the life history of the mosquito. Find the stage in which it is most easily destroyed.

4. Formulate plans for and assist in the destruction of the breeding places of mosquitoes if malaria is a problem in your community.

5. Make a list of all the superstitions in regard to disease held by your family. Show how each is unscientific.

6. How many colds do you have each season? What may be the cause?

7. Determine the number of hours lost from classwork during the past month because of colds.

8. What is the wise attitude toward staying out of school when one is sick? When should one return to school after an illness?

9. Suppose your city were threatened with a typhoid epidemic. Outline the probable procedure of the board of health and list your part in fighting the epidemic.

10. Visit or write your local board of health to get the last annual report of communicable diseases.

Tests

I

Directions: On a separate piece of paper make a list of letters from A to J, corresponding to the letters of the items in the first group given below. After each letter place the number of the item from the second group that correctly completes the statement. Do not write in the book.

A. The white corpuscles in the blood
B. The body becomes immune to disease
C. Vaccine
D. Germs cause diphtheria
E. Antitoxin
F. Toxin-antitoxin
G. Schick test
H. Polluted milk
I. Breaks in the skin
J. Malaria is caused

1. by manufacturing antibodies.
2. by a protozoan.
3. devour disease bacteria.
4. by producing toxins in the blood.
5. protects the body against diphtheria.
6. is used in the treatment of diphtheria.
7. is obtained from healthy cows.
8. is a means of spreading typhoid fever.
9. determines if an individual is susceptible to diphtheria.
10. permit the entrance of bacteria.

II

Directions: On your sheet of paper write down, from the list of suggestions given below, the number of the one which you think might solve the problem. Give the reason for your choice. Do not write in the book.

When Jane Reed was six years old she had smallpox from which she recovered. Her four-year-old brother, John, was immediately vaccinated and did not contract the disease. Six years later an epidemic of smallpox, traced to a family in an auto trailer camp, occurred. At this time the mother of Jane and John wanted to do the best thing to pro-

tect her children. What do you think is necessary in this situation? State your reason.

1. Have both children vaccinated immediately.
2. Since both children had become immune, nothing need be done.
3. Have the home quarantined.
4. Have Jane vaccinated immediately.
5. Have John vaccinated immediately.

III

Directions: On your sheet of paper write the letters from A to H, corresponding to the letters of the practices given below. Place a check mark (✓) to the left of the letters indicating the practices which you consider good. To the right of the checked letters place the numbers for the reasons supporting the practices which you consider good. Do not write in the book.

Jack Brown is coming down with a cold. He does not feel ill, but his eyes are watery, he has a running nose, and he sneezes frequently. He wants to put into practice the best methods for dealing with a cold. What should Jack do?

A. Take aspirin regularly until the symptoms disappear.
B. Eat lightly and go to bed until the condition has cleared.
C. Take a cathartic.
D. Increase his food intake above the normal amount required at his age until the cold has disappeared.
E. Use a nasal spray or an ephedrine preparation which he saw advertised to keep the nasal passages clear.
F. Exercise vigorously in the gymnasium and follow it by a warm bath and cold shower.
G. Gargle with an antiseptic solution.
H. Try not to infect others by taking precautions as to sneezing, avoiding crowds, disposing of secretions from the nose and throat.

---

1. Constipation predisposes to colds, so a cathartic is important in treating a cold.
2. "Feed a cold and starve a fever" is a common saying.
3. Nasal sprays containing ephedrine tend to clear the nasal passages and make breathing easier.

4. It is the civic duty of everyone to help prevent the spread of any disease.
5. Rest, in an even temperature, and proper food will permit the body to build up a general resistance that will overcome the disease.
6. Taking aspirin is one of the best treatments for preventing colds.
7. Avoiding undue fatigue will help in preventing and curing colds.
8. A good sweat helps to get rid of a cold.
9. The germs which cause colds infect the membranes of the nose and throat and may be removed by an antiseptic gargle.
10. Laboratory tests of popular antiseptics have shown that they do not kill most disease-producing bacteria.

Associated subjects

Biology: Preparation of culture plates to demonstrate the presence of bacteria everywhere and the need of bacteriologic cleanliness. . . . The fact that bacteria may be useful as well as harmful. . . . The cause, means of transmission, channels of infection, treatment, and immunization of the common communicable diseases. . . . The necessity for sterilization, pasteurization, the use of germicides, and other hygienic practices. . . . A presentation of the fields of investigation that are open for future study by learning of the contributions of great bacteriologists, past and present. . . . The responsibility of the individual in preventing communicable diseases.

Chemistry: The study of chemicals used as germicides. . . . The value of various antiseptics.

Health service: Instructions as to the care of the sick in the home, especially for communicable diseases. . . . Data on communicable disease control.

Home economics: The selection and care of articles for the sickroom. . . . The preparation of special diets for the sick and convalescent. . . . The responsibility of the individual and the family toward quarantine rules.

Physical education: Reasons for sanitary care of the shower rooms, and the use of individual towels and other toilet articles. . . . The danger involved in wearing the clothing of others. . . . Practice of wearing special clothing immediately after vigorous exercise. . . . Need of rest periods for the underweight individual. . . . Restriction of activity following a period of illness.

Social science: The economic and social implications of epidemics and health as an important factor in the efficiency of the people. . . . The need of adequate laws for controlling disease. . . . The responsibility of a community with regard to free supply of such disease-control substances as vaccines and antiserums.

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Armstrong. *Colds Aren't Trivial.*
Bayles and Burnett. *Biology for Better Living.*
Byrd. *Health Instruction Yearbook.*
Carlson and Johnson. *The Machinery of the Body.*
The High School's Part in Tuberculosis Control. National Tuberculosis Association.
Low. *Science Looks Ahead.*
Malaria and Its Control in the Tennessee Valley. Tennessee Valley Authority.
Ogburn. *The Social Effects of Aviation.*
Ritchie. *Biology and Human Affairs.*
Turner. *Personal and Community Health.*
Wheat and Fitzpatrick. *Health and Body Building.*
Williams. *Healthful Living.*

Films

Behind the Shadows. 15 minutes, sound. National Tuberculosis Association.
Body Fights Bacteria. 17 minutes, sound. McGraw-Hill.
Cloud in the Sky. 18 minutes, sound. National Tuberculosis Association.
Defense Against Invasion. 12 minutes, sound, color. Office of Inter-American Affairs.
Fight for Health. 20 minutes, sound, color. National Tuberculosis Association.
The House Fly. 11 minutes, sound. Encyclopaedia Britannica.
Man Against Microbe. 10 minutes, sound. Metropolitan.
They Do Come Back. 17 minutes, sound. National Tuberculosis Association.
Tuberculosis, Its Diagnosis, Treatment, and Control. 11 minutes, sound. Encyclopaedia Britannica.

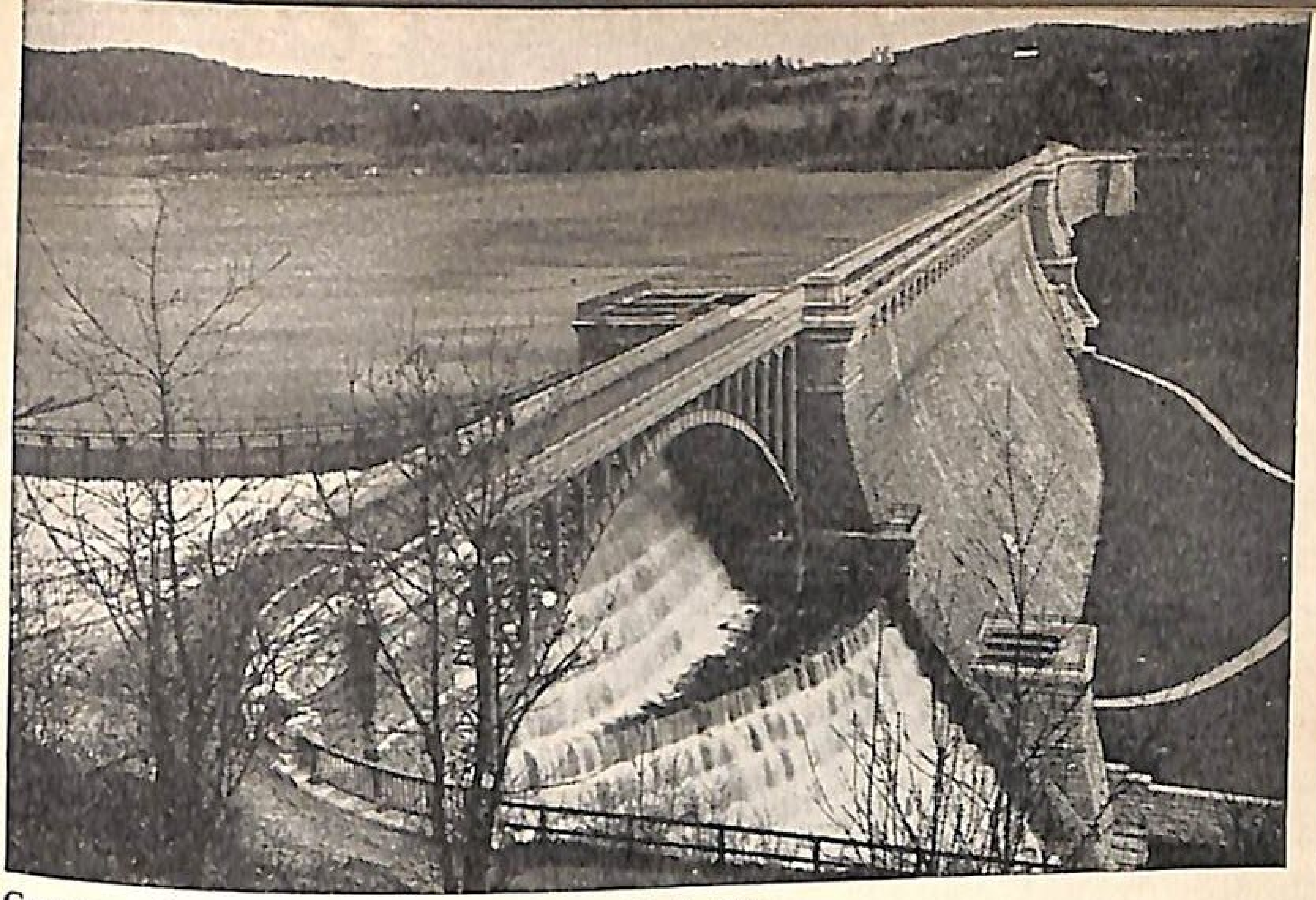
26. YOUR COMMUNITY HELPS TO AFFECT YOUR HEALTH

YOUR health depends on living in an environment in which good air, pure water, and wholesome food exist and in which communicable diseases, smoke, and noise are absent.

As cities grow in size, the problem of maintaining a healthful environment becomes increasingly complicated. Experts must be consulted, and scientific study of the conditions is necessary. As a member of the community you should be interested in public health and, with thorough understanding of the principles involved, give your support to every project. You should also know that regulations are necessary and are to be respected, even though they may sometimes interfere with personal comfort.

Do you know . . .

1. *Why co-operation is necessary in keeping a city healthful?*
2. *What some of the health problems are that every community has to solve?*
3. *Why a pure water supply is important?*
4. *How water may become polluted?*
5. *Why adequate disposal of sewage is so important?*
6. *Why pasteurization of milk is important in large cities?*
7. *Why food inspection is necessary?*
8. *Why quarantine laws should be observed?*
9. *How smoke and noise menace health?*
10. *How and why the health of factory workers should be safeguarded?*
11. *How careful city planning benefits the individual?*
12. *What factors should be considered in choosing a home site?*
13. *Why adequate recreation centers should be provided?*
14. *What things each boy and girl can do today toward making his community a better place in which to live?*
15. *How undulant fever is spread?*
16. *How milk is graded?*
17. *What is the modern method of sewage disposal?*
18. *What makes water hard?*



Courtesy Board of Water Supply, New York City

NEW YORK CITY obtains its water supply from giant reservoirs like this, which supply the city with 875 million gallons of water every day.

The modern city. In order that the best standards of healthful living may prevail in a community, careful planning for the whole city is necessary. The plans should include the establishment of a reasonably pure water supply, adequate disposal of waste, proper food inspection, enforcement of quarantine laws, protection of factory workers, control of traffic, abatement of smoke and noise nuisances, and fire and police protection. And no less important is the carrying out of plans for good housing and centers of recreation.

The water problem. In six leading cities of the United States, the daily consumption of water for all purposes varies from 67 to 270 gallons for every inhabitant. Water used only for cooking, drinking, bathing, laundry, and other domestic purposes ranges from 10 to 17 gallons daily per person. In some small country places, on the other hand, the amount each person uses daily is sometimes little more than one gallon. This range illustrates the free and perhaps careless use of water where it is easily obtainable and its limited use where the supply is scarce.

Cities have generally developed in regions where water was readily available: at the junctions or mouths of streams or on the shores of lakes and oceans. In the western United States, most cities get their water supply from the mountain areas that are sparsely populated and so are comparatively free from contamination.

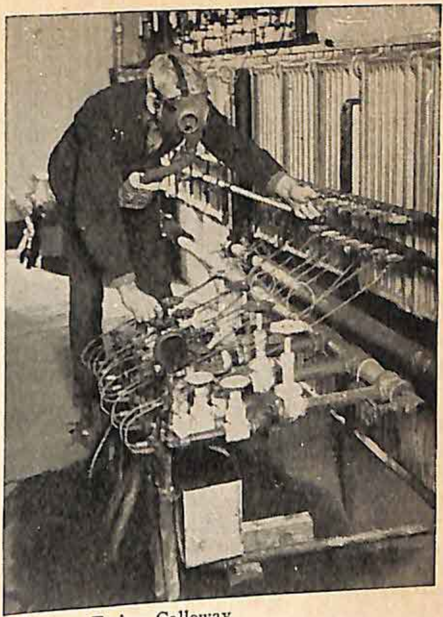
Safe water. The quality of water cannot always be judged by its appearance. A glass of clear water may contain thousands of typhoid germs without showing the slightest trace of sediment. Good water should also be free from suspended matter, sand or clay, and poisonous metals, particularly lead and arsenic.

Water is said to be hard if it requires an unusual quantity of soap to produce a lather. The hardness is due to two kinds of salts, carbonates and noncarbonates, especially those of calcium and magnesium. According to the nature of the minerals causing the hardness, the water may be softened by boiling or by adding a soluble chemical, such as sodium salt. When soap is added, the calcium and magnesium compounds act chemically with the soap to form an insoluble scum. Until all the calcium and magnesium compounds have been acted upon, no lather can form and little cleansing can be accomplished. Hard water is unpleasant to use on the body because of its drying action on the skin. Where hard water exists, the community should endeavor to install a softening process so that families do not have the expense of buying extra soap required for hard water.

Purification of water. In populated areas water is never free from the possibility of contamination. Therefore safety measures for purification are now used. The germs can be killed by means of ozone or by chemicals which liberate chlorine. Various impurities are removed by means of rapid sand filters, slow sand filters, and settling ponds. One or more of these methods is used by practically every municipality.

Pollution of water. It is not easy to detect the presence of typhoid bacilli or other disease germs in polluted water, but the colon bacillus which occurs normally in the intestine of man and domestic animals is easy to discover. Its presence or absence is a good indication of the pollution or purity of the water in question. Chemical tests are also made to detect the presence of chlorine and nitrogen in various forms. Nitrates are valuable indicators of pollution because their main source is in body wastes. The nitrogen tests detect the presence, nature, and the quantity of the pollution by intestinal waste material.

Disinfection of water. On the other hand, chlorine is added to the water in the form of chlorinated lime (bleaching powder) or free chlorine gas, to kill the bacteria present. The addition of chlorine often gives a disagreeable taste to the water if the amount is not carefully controlled. Adding ammonia makes it possible to use less chlorine and reduce the probability of a disagreeable taste. The amount of chlorine necessary to disinfect water depends upon the amount of the organic matter present.



Courtesy Ewing Galloway

THIS MAN in the gas mask turns a valve which controls the amount of chlorine gas to be put in the water supply of a city. Sufficient gas is introduced to kill any harmful germs but not to be injurious to health or affect the taste of the water.

Emergency treatment of drinking water. The traveler or camper is occasionally compelled to use drinking water of doubtful quality (see p. 424). The simplest, safest, and best method for making water safe is to boil it for ten minutes. Many people dislike the flat taste of boiled water, especially if it cannot be made cold after boiling. To overcome this flatness, the boiled water may be used in making tea or some other hot beverage which has a distinctive flavor.

The swimming pool. Water in a swimming pool is easily polluted, so special precautions should be taken to keep it pure. Any pool suspected of contamination should be avoided. Water in indoor pools should be kept in a sanitary condition by filtration, by chlorination, and by gradual and continuous replacement with cities get their water supply from the mountain areas that are sparsely populated and so are comparatively free from contamination.

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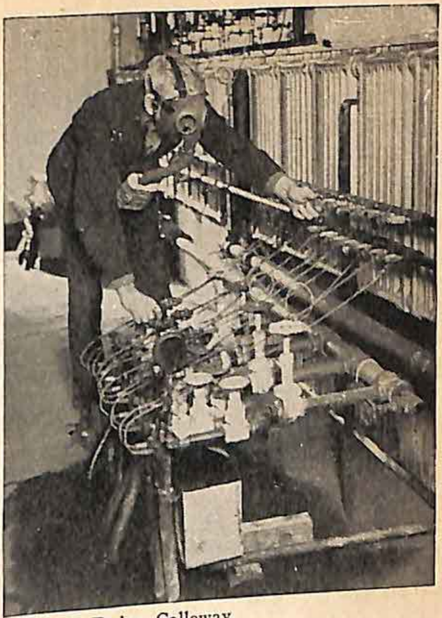

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Courtesy Los Angeles County Chamber of Commerce

A SWIMMING POOL provides both health and fun and is a haven of comfort on a hot summer day. However, water in a swimming pool is easily polluted, and any pool suspected of contamination should be avoided.

pure water. Periodic tests of the water should be made as to freedom from colon bacilli and to show the presence of sufficient chlorine. Visible dirt, scum, or floating matter should not be present.

Sewage disposal. One of the most important health problems that confront every community is sewage disposal. Sewage consists of excreta, mixed with the sink wastes and other waste waters going from houses, street surfaces, and manufacturing plants. In a large city, the problem of sewage disposal is so complicated that it requires the service of a sanitary engineer. In every locality, however, the fundamental principles involved are the same. The sewage should be treated in such a way that all dangerous germs are killed, and it should be disposed of in a manner that is sanitary for the whole country as well as for the immediate neighborhood. Carelessness in disposing of sewage from houses where there are cases of intestinal disease, such as typhoid and dysentery, may result in a serious epidemic—sometimes near by, sometimes many miles away—along the course of the polluted stream.

Sewage made safe. In the past, many cities have allowed the sewage to flow directly into large lakes, rivers, or the ocean. Today, however, attempts are usually made to purify the sewage previous to its disposal. This is done either by the use of chemicals or by bacterial action. Chemicals such as a strong alkali or acid or chlorinated lime may be used to disinfect sewage.

Purification by bacterial action depends upon two types of bac-

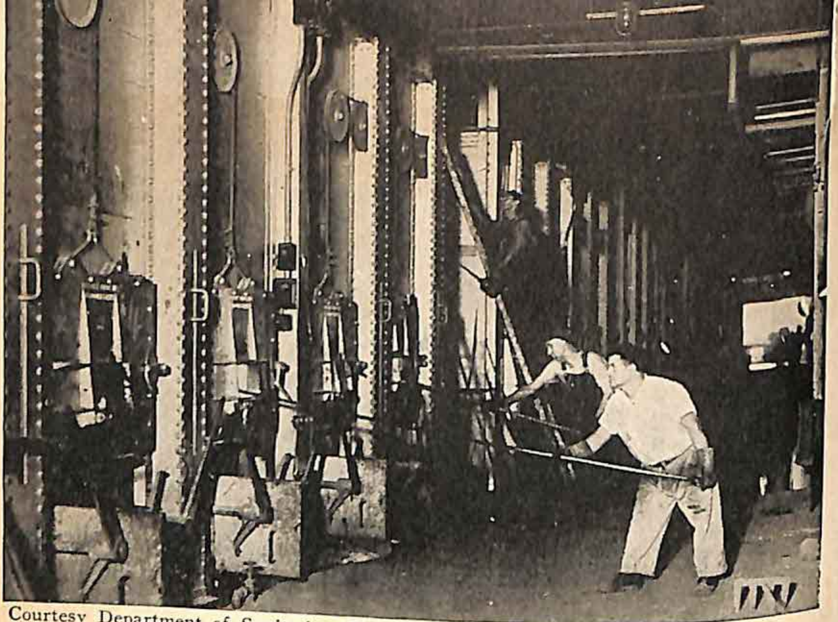
Courtesy Fairchild Aerial Surveys

THE SEWAGE disposal plant on Ward's Island, which cares for one-fifth of the city's billion gallons of waste daily, is a part of New York's sewage disposal system. When completed, this system will destroy all harmful germs that may be found in the waste of homes. Before these plants were built, sewage was dumped into near-by rivers and the Atlantic Ocean, making the beaches dangerous for bathers.

teria: one which grows in the presence of oxygen, called *aerobic* bacteria, and the other which grows in the absence of oxygen, called *anaerobic* bacteria. To permit bacterial action in the absence of oxygen, sewage is held in deep settling or septic tanks for long periods.

To supply oxygen to the aerobic bacteria, the sewage must be brought into contact with a large amount of air. This is done by spreading the sewage over the surface of the ground, by sprinkling it over porous beds of broken stone, coke or clinkers, or by forcing air into the sewage tanks. In the latter case, the sewage is held in tanks, and air is forced in fine bubbles up through the sewage to the top of the tank.

In actual practice, no one process is used alone, but two or more processes may be used together. The sewage of a city may first pass through screens or sedimentation to remove solid material, then into septic tanks for anaerobic action. The liquid which flows off from the septic tank may be carried to a sprinkling filter. The liquid from the filter may be disinfected with chlorine before being allowed to flow into a lake or stream.

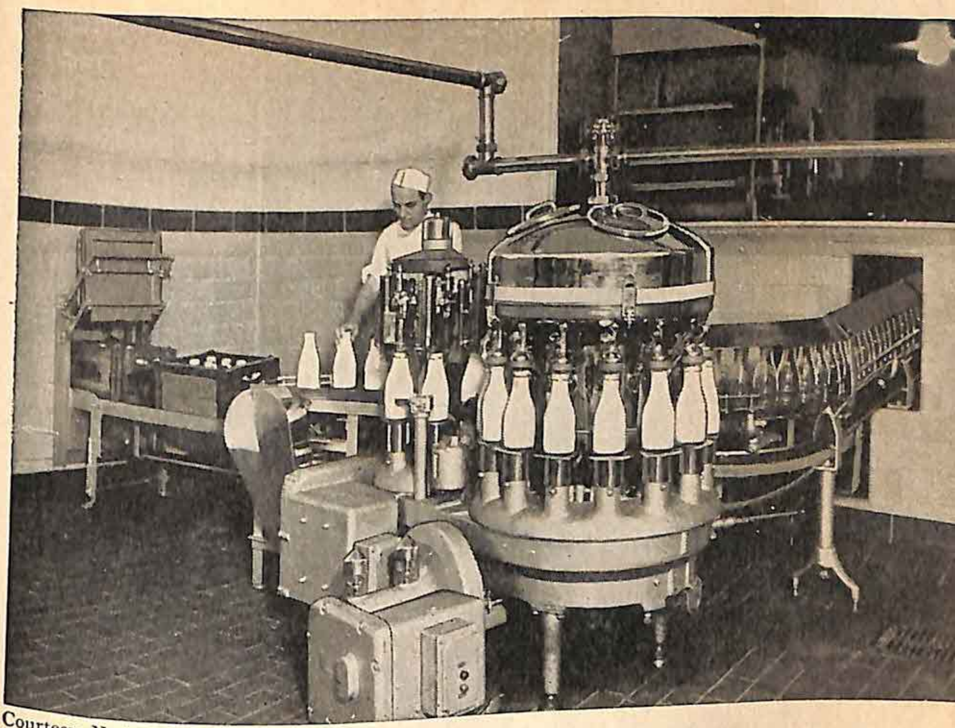


Courtesy Department of Sanitation, New York City

SEVERAL HUNDRED tons of waste are burned daily by New York City. This means that the large incinerators are constantly kept busy.

The removal of garbage. If kitchen wastes are not properly cared for, they will attract rats, mice, and insects, as well as undergo decay which becomes disagreeable. They should be collected in metal cans having tight covers and be kept free from ashes and other materials. The can should be often emptied and scrubbed with hot water and soap. It should be protected on the inside with several thicknesses of old newspapers, which will help to keep it clean. In the city, garbage and other refuse are usually collected and disposed of by city employees. In rural districts and in small towns, the most economical method of garbage disposal is to feed it to hogs. Garbage in small amounts may be burned in the kitchen range, although there is a possibility of causing a disagreeable odor; or it may be buried in the earth.

Incineration. Some cities dispose of garbage by first extracting the fat and then using the residue for fertilizer. This process often costs more than the products are worth. Other cities find it more economical to burn the garbage along with the miscellaneous rubbish. Large incinerating plants are built in convenient locations, and the garbage and other refuse are reduced to ashes



Courtesy National Dairy Council

STERILIZED BOTTLES are filled with milk and capped automatically.

without smoke or odor. New York City burns 700 tons of waste a day in garbage and refuse incinerators.

Buying food for health. Food has already been considered from the standpoint of the individual's choice of diet (see chap. 12). We shall now consider how food must be handled and distributed so that it will be safe to select. Food that is purchased varies greatly in quality. It becomes dangerous when it contains poisonous preservatives, harmful bacteria, or animal parasites.

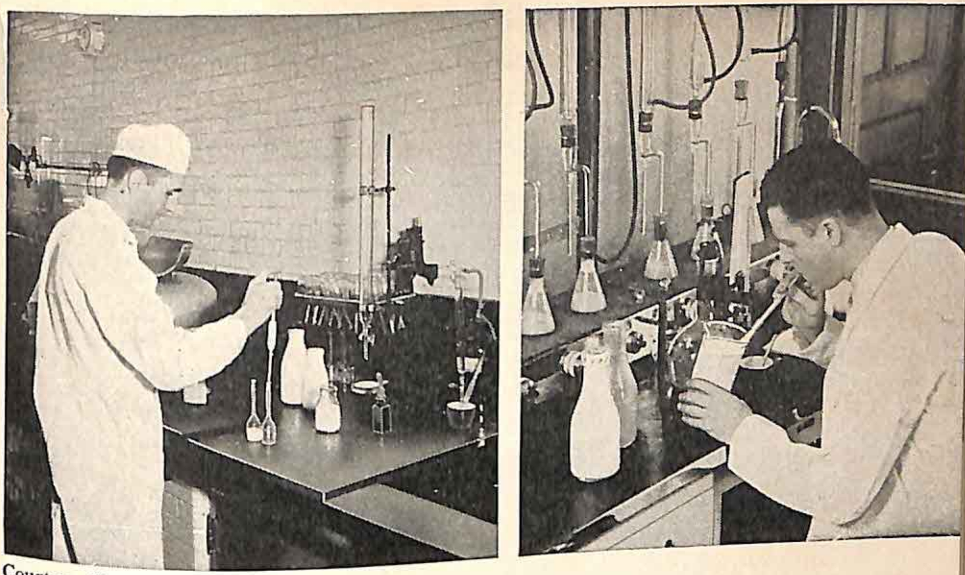
Federal Food, Drug, and Cosmetic Act. The public is entitled to know what kind of food it is buying. What the individual buys depends upon his own selection. The Federal Food, Drug, and Cosmetic Act of 1938 (see p. 358) provides that foods shall be sold for what they are, and not passed off for first quality where they are not so. This, however, does not prohibit, or always indicate, the selling of inferior foods or even foods of second quality. In buying food, the first consideration should be cleanliness and wholesomeness. This may include food of second quality—that is, small-sized peaches, less tender cuts of meat—which have good food value.

Dangers lurking in milk. Milk is used in enormous quantities. To keep it in a sanitary condition is difficult. It is especially important that milk should be clean because it is the one animal food eaten raw in great quantities. Since it is not a clear fluid, dirt can hide in it readily. It is a good medium for rapid bacterial growth unless it is kept at a low temperature. Milk very often has to be produced at a considerable distance, sometimes 300 miles from the point where it is finally used. In order to control the spoilage of milk and the danger of disease, there is a Federal requirement that the temperature of milk transported across state lines must not exceed 50 degrees Fahrenheit.

Bacteria in milk. Not all bacteria found in milk are disease-producing. Lactic-acid bacteria cause milk to sour by breaking down the milk sugar into lactic acid. Milk sours if conditions favor the development of acid-forming bacteria. Milk which is simply sour may have a disagreeable taste, but it is not injurious to health. Milk decays when certain bacteria break down the proteins. Such milk is alkaline in reaction and bitter to the taste and may be injurious to health.

Besides the many harmless bacteria, milk may contain the germs of tuberculosis, typhoid fever, diphtheria, septic sore throat, dysentery, undulant fever, or diarrhea. Undulant or Malta fever is not unlike typhoid fever (see p. 398). It is caused by a micrococcus and is primarily a disease of goats and cows. It may be contracted by man through drinking raw milk of infected goats or cows.

The possible dangers from the presence of any of these bacteria may be greatly reduced by *pasteurization*. This is a process by which milk is heated to a temperature of from 142° to 155° F. (62° to 68° C.) for at least thirty minutes. By this means, most of the bacteria are killed, and all the disease organisms which may be transferred by milk are destroyed. Heating milk to this tem-



Courtesy National Dairy Council

MILK is tested in the laboratory for butterfat (*left*), for other food solids, for acidity to indicate keeping quality (*right*), for sediment to indicate sanitary conditions on the farm, and for the bacterial count.

perature does not alter its taste, odor, or digestibility and does not interfere with its food value. Quick pasteurization at 165° F. for fifteen seconds is also used.

Various grades of milk. Milk varies greatly in sanitary quality and in nutritive value. Milk should, therefore, be graded as to these characteristics. To secure clean and safe milk, definite standards are usually observed. The U. S. Public Health Service publishes semiannually a revised list of communities meeting the milk requirements of the Public Health Service Milk Ordinance and Code. This ordinance recognizes two grades of milk: Grade A, pasteurized; and Grade A, raw milk.

Certified milk, which represents about one percent of all milk sold in the United States, is the highest quality of raw milk from tuberculin-tested cows kept in sanitary conditions. Bacterial examinations of the milk are made weekly. The number of bacteria contained is limited to 10,000 per cubic centimeter when delivered; and delivery must be made within thirty-six hours after the milk is produced. In many areas certified milk may be obtained as "raw certified" or "pasteurized certified."

Most administrative areas now recognize only one grade of milk, called "approved" milk. Approved milk must be pasteurized and must have had a bacterial count below 200,000 per cubic centimeter before pasteurization. Other names are allowed for approved milk which contains extra fat, added vitamin D, or dispersed butterfat (homogenized).

Some cities have two grades of milk: Grade A (raw or pasteurized), usually with a bacterial count below 50,000 per cubic centimeter on delivery, and a lower grade which is pasteurized.

Safe meat. Careful inspection of meat is also very important, since meat may carry the germs of paratyphoid fever, botulism, tuberculosis, or anthrax, or the parasitic worms—tapeworm and Trichinella. The inspection should be carried on by Federal, state, and local health agents in order to eliminate diseased and otherwise bad meat from the food supply. Federal inspection is now limited to the products of establishments that are engaged in interstate or foreign commerce. This provides for inspection during slaughter and storage and when the meat is released from storage. Meat is shipped under bond and is inspected at its destination when unloaded from the train or boat. Each state and municipality ought to supplement the Federal inspection service with an efficient local inspection system.

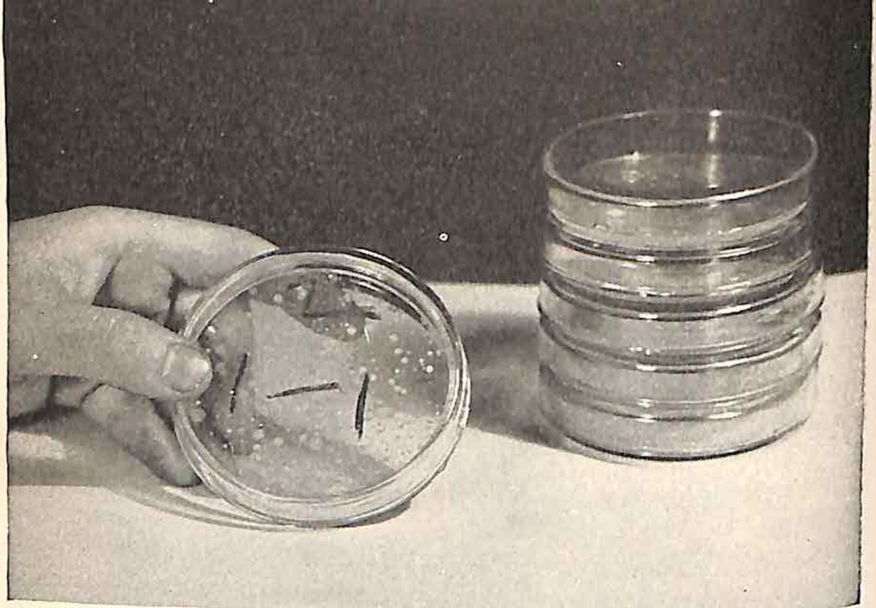
Thorough cooking is always a safeguard against disease germs and parasitic worms in meat with regard to whose reliability there is any question.

When there are shortages of meat, some is purchased from illegal sources, commonly referred to as the "black market." Always lacking government inspection, such meat is usually slaughtered in insanitary surroundings and stored under poor or no refrigeration. This practice is especially dangerous with regard to pork. Trichinella and tapeworm, two parasitic worms often found in pork, die if the meat is kept for thirty days at a temperature of 5° F. (—15° C.). The retail purchaser of meat should always look for the government stamp: U. S. Inspected and Passed.

Courtesy U. S. Public Health Service. Photo by Rothstein.

THE RESTAURANT inspector on the left is taking a specimen from the rim of the glass with a cotton swab. This will be placed in a sterile test tube, well-stoppered. Later, in the laboratory, the specimen will be examined to determine the number of bacteria it contains. The inspector at the right is looking at a glass which is apparently clean and polished but may contain many harmful germs.

Food prepared outside of the home. Restaurants, food stores, bakeries, candy shops, and other places where food is prepared and sold should be inspected and supervised so as to insure sanitary conditions. An outbreak of food poisoning, traced to an insanitary bakery, occurred in one of our western cities. More than twenty-eight families were involved. The food poisoning, apparently due to staphylococci, was traced to cream custard cakes that had become contaminated during the preparation, storage, and handling of the custard.



Courtesy U. S. Public Health Service

THESE PETRI dishes were inoculated from specimens taken from utensils in restaurants. After an incubation period of 48 hours at body temperature, spots formed. The spots, or colonies, when examined under a microscope showed a mixture of bacteria, staphylococci, and streptococci. To be satisfactory, the bacterial count should not be more than 500. The black figures on the cover are used to identify the culture.

Medical examinations should be required of all food handlers. In some states, the state board of health requires a health certificate of all persons engaged in the preparation or handling of food. No person harboring the germs of typhoid or any other infectious disease should be allowed to handle food. Both in the home and in public eating places, tuberculosis, influenza, and other communicable diseases may be carried from diseased persons to healthy individuals on unscalded dishes.

Prevention of infectious diseases. Prevention of the spread of infectious diseases depends upon adequate quarantine regulations and isolation of the sick. If every person would co-operate in observing these rules, we could all live more safely.

Many cities have a set of regulations for the control of communicable diseases (see chap. 25). Some of the regulations of the City Health Department of Denver, for example, follow:

Chicken pox. A child with chicken pox will be isolated from the first appearance of the rash until the crusts have disappeared.

Diphtheria. Quarantine begins from the date of positive culture until two successive negative nose and throat cultures are obtained.

Measles. A child with measles must be out of school from the onset until five days after appearance of rash.

Mumps. A child with mumps will be isolated from the time of onset of the disease until all swelling has disappeared.

Poliomyelitis (infantile paralysis). Quarantine lasts for not less than ten days from the date the disease is reported. No person is permitted to enter or leave a house so quarantined.

Scarlet fever. All cases of scarlet fever will be quarantined, the period of quarantine to be determined by the health officer. In cases where no report is made to the health department at the time of diagnosis, the quarantine period will be arbitrarily fixed at twenty-eight days. Children who are contacts may return to school seven days after the last date of contact, provided they have been removed to a new address during the seven-day period.

Typhoid fever. Pupils, teachers, custodians, and other school employees who have the disease cannot return to school until they have obtained two negative feces and urine reports. Pupils who live in a house which is quarantined for typhoid fever may continue in school provided they take the typhoid vaccine and change their residence before coming back to school.

Whooping cough. The period of quarantine is not less than three weeks from the onset of the stage when the patient coughs and chokes. School children who are contacts who have not had whooping cough are excluded from school for twelve days after the last exposure.

"Nuisances." One of the early duties of public health officials was the suppression of "nuisances." The so-called nuisances may be mere sources of annoyance, or they may interfere with health. Some of the things that are regarded as nuisances are weeds, ashes, garbage, dumps, dead animals, dirty yards, faulty cellars, defective plumbing and drainage, overcrowding of tenements, unclean streetcars, and spitting in public places. Noise and smoke are considered as nuisances, and their presence may impair health.

Noise. In any large city there are many kinds of noise. Noise may result from the keeping of animals, the use of bells and gongs, the opening of cutouts on automobiles, and the unreasonable use of horns, musical instruments, and radios. But the greater part of the noise of a city is caused by traffic and not by the things of which people generally complain.

There is experimental evidence that noise does have a detrimental effect on health. Sudden and intense noises are likely to create a fear reaction. Repeated noises disturb the nervous system and cause undue fatigue. Investigations also show that a worker cannot do his best work in a place that is noisy. That there is a widespread interest in reducing harmful noises is shown by the establishment in large cities of commissions whose work it is to attempt to lessen this nuisance. The committee on the elimination of harmful noise of the National Safety Council of the United States is taking an active part in antinoise campaigns.

Smoke. Smoke is unburned fuel; so to burn smoke is often good economy. The presence of smoke increases the cost of cleanliness. Where air is smoky, there is a definite loss of daylight and the ultraviolet light available from direct sunlight is greatly reduced. Acid fumes in the air are irritating to the nose and throat, and in smoky localities these fumes are present in great quantities. Smoke also interferes with plant growth by its chemical action and by clogging up the pores of the leaves. How to decrease or abolish smoke in our cities is another public health problem. Certain cities have proved that by constructive effort smoke can be abated.

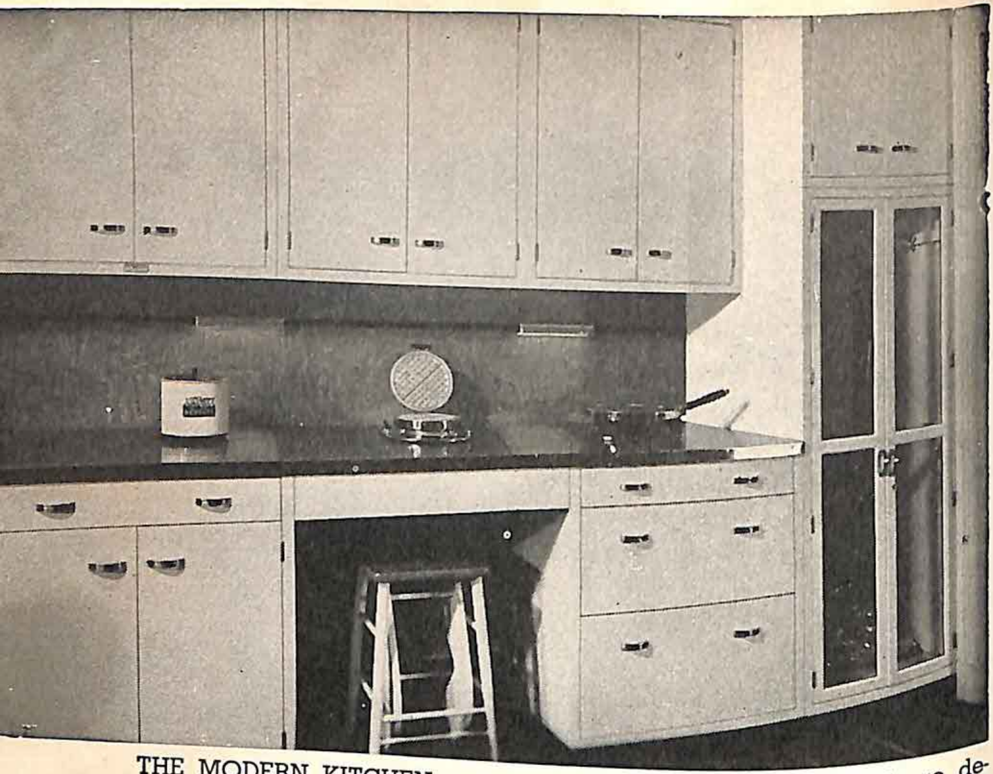
The industrial worker. Improvement of industrial working conditions is a fundamental national problem which is receiving more consideration today than ever before. One evidence of this is the fact that many industrial companies are members of the National Safety Council which was organized in 1913. Every effort should be made to protect the health of the worker in all industries. There is a tendency to do this by regulating the hours of work and by providing a healthful environment with regard to ventilation, heating, lighting, sanitation, and control of disease. Furthermore, in the best regulated industries, safety devices and work tools which save the worker's energy are provided. Recreation and health education programs are given. Medical supervision and financial compensation for the injured give the worker a feeling of security. These activities not only protect the health of the worker by reducing the number of accidents and the frequency of infectious diseases, but they increase the efficiency of the worker and the amount of work done.

Healthful homes for city dwellers. In earlier times, cities developed in a haphazard way. A man who bought a piece of land could put up any kind of building with little or no restrictions. This resulted in a ridiculous, unhygienic, and inartistic jumble of residences and flat-store buildings. Under the modern zoning system, certain parts of the city are set aside for family homes with gardens and playgrounds, and other areas are used for apartment houses, built according to certain restrictions. In the future, schools, churches, and libraries will be built near the residence areas but away from the annoyances of factories and the dangers of traffic. Stores and small factories will be located on the streets where streetcars are run.

This plan cannot be generally applied to parts of the city already built up, because of the expense involved in reconstruction, but newer sections should be planned according to a zoning system. In either case, there must be building ordinances that will insure some degree of protection from fire, provide for light and air, and require sanitary sewage disposal and safe lighting. These regulations are especially necessary where people live crowded together in buildings owned by others.

The permanent home. No matter what one's income is, one should make every effort to live in as healthful surroundings as possible. Nearness to work and convenience of transportation, the price of rent, and the general tone of the neighborhood are important considerations in determining the location of the home. Whether one can build his own home or whether one must rent a house or apartment, one should try to obtain certain essentials.

Air and light should be first considerations. Every room should have at least one window opening into a large court or the wide-open outdoors. Plumbing should be examined to see that there are no wet places suggestive of leaks. The bathroom should be well warmed in cold weather to make bathing safe and pleasant.



THE MODERN KITCHEN contains labor-saving devices and is so designed as to be kept clean easily and to save the housewife unnecessary steps.

The bathtub and lavatory should have smooth surfaces so that they can be kept clean easily. Floors and walls of all rooms should be even and tight so that dirt cannot collect, and so that there will be no cracks to furnish hiding places for insects. Heating arrangements should be such that fresh air can be brought in without chilling the rooms in the winter.

The temporary home. The same care that is taken in deciding upon a permanent home should be considered in selecting the camp or the rural boarding house which is to serve as a temporary home in summer. Vacation is not the time to ease up on hygienic regulations. Even greater care of one's health is necessary in unusual surroundings. Usually there are fewer conveniences than at home for taking care of food and water. Dangers which we avoid at home should not be accepted when away from home.

The schoolhouse. Modern standards for the hygienic schoolhouse require that the location shall be on ground that is well drained and free from mud, away from noise, surrounded by trees, grass, and flowers, and with adequate space for play. The school should be near the residence areas, convenient to transportation, but away from the disturbances and dangers of traffic. The building should be so constructed and the seating so arranged, that light will come through the windows at the left of the pupil. The heating and ventilating system should be so planned that the temperature can be kept easily at about 68° F. Blackboards should never be placed on the same side of the room as the windows nor opposite them. Ceilings and the upper parts of the walls should be white in order to reflect as much light as possible. Desks should be individual, movable, and adjusted to the height of the pupil. Adequate fire escapes and safety devices, such as alarms and fire extinguishers, should be provided.

The building should be kept clean. Conveniences, such as soap and warm water, should be provided in order that pupils may wash when necessary. Individual paper towels should be available. Pure drinking water should be accessible at all times, either from a sanitary fountain or from paper cups. The toilets should be strictly sanitary and supplied with the necessary supply of paper. A sanitary and beautiful school should be the ideal of each pupil, and he should do his share toward making and keeping it a place to which everyone can point with pride.

Planning for recreation. People, young and old, should be encouraged to take wholesome and health-giving recreation. They should be induced to use their leisure time for improvement of their bodies and minds. This cannot be done unless centers of recreation are provided that are readily accessible. There should be in every city many small parks with tennis courts and play apparatus for children, as well as smaller open spaces with playgrounds and benches. Bathing beaches, boats, golf courses, public gymnasiums, swimming pools, camps, forest preserves, and competitive activities under adequate supervision are being provided by many cities at public expense.

A small model city. A striking illustration of city planning is the town of Radburn, New Jersey, whose size is limited to thirty or forty thousand people. It is designed for families with children, and every house faces a lovely park. Every resident is given a chance to have grass, trees, and a garden. It is the first town in which the place of the automobile is fully recognized and planned for. Children may walk from the front door of their homes to their schools without once having to cross streets through automobile traffic. The town is to be developed out of a series of neighborhoods, each neighborhood being large enough to have at its center a modern school and community building, with athletic fields, swimming pools, and other recreational facilities.

In conclusion

THE onward progress of civilization has made us more and more dependent on one another. At the same time, the problem of living healthfully and agreeably with each other becomes more and more complicated. Our ideal should be to create a community in which there is a minimum of depressing influences and a maximum of influences which stimulate health and appreciation of beauty.

Activities

1. Describe the water supply of your city.
2. Find out how your own or a neighboring city disposes of its sewage.
3. Report to the class the conditions existing in your community with reference to disposal of garbage, ashes, and other household wastes.
4. Make a study of your milk supply. What is your state doing to protect you from milk-borne diseases?
5. Accompany a food inspector on his rounds some day and tell the story.
6. Find out what is being done in your community officially to reduce smoke, noise, and vermin.
7. Take snapshots in your city to illustrate (1) homes lacking the conditions necessary for wholesome living, and (2) other homes that are economical but hygienic.
8. Make pictures and maps to illustrate faulty and good zoning plans.

Test

Directions: On a separate sheet of paper write a column of numbers from 1 to 13, corresponding to the numbers of the statements given below. Place a letter after each number as follows. Do not write in the book.

A, if you agree with the whole statement.
U, if you are uncertain how you feel about the whole statement.
D, if you disagree with the whole statement.
X, if you do not understand the statement.
(Check each statement; omit none)

1. I believe that most of the homes in our city have plenty of sunlight.
2. I believe that easy means of transportation are available for almost all who must go to work daily.
3. I believe that many homes in our city do not have proper ventilation.
4. I believe that most children in our city live near their schools.
5. I believe that a large number of homes in our city have insanitary outdoor toilets.
6. I believe that most of the bakeries, food stores, and meat markets in our city are inspected periodically by a city inspector.
7. I am sure that nearly all the homes in our city are kept comfortably warm in winter.
8. I am sure that nearly all the homes in our city have modern bathrooms.
9. I am sure that all the schoolhouses are built according to modern standards of hygiene.
10. I think that all persons in our city who handle or prepare food outside of the home should be required to take a medical examination.
11. I think that every effort should be made to protect the health of the workers in all the industries in our city.
12. I think that children do not need much sunlight and fresh air in the homes, for they get enough of these out-of-doors.
13. I think that a special effort should be made in our city to reduce the noise in the streets about our homes.

Associated subjects

Biology: The meaning of sanitation and the relation of bacteria to decay (decomposition), to changes in milk, and to diseases. . . . The need of pasteurization, sanitary milk and food supplies, pure water, and modern methods of sewage disposal in maintaining community health. . . . The effect of physical factors, such as noise, smoke, and dirt, on individual health.

Chemistry: The chemical changes that result from bacterial action . . . The chemicals used in disinfecting water and sewage. . . . The analysis of water and milk.

Home economics: The buying and preserving of food; selection and sanitary care of the home; and problems of lighting, heating, ventilation, refrigeration, and cleaning. . . . The responsibility of each individual in helping to keep the community healthful.

Physical education: The responsibility of young people in avoiding those who have communicable diseases and in reporting infections. . . . The danger resulting from the use of insanitary swimming pools.

Physics: Sanitary plumbing and the principles involved in heating, ventilation, and lighting.

Social science: The responsibility of the individual to the community in the observance of laws regulating public health. . . . The need for community planning and organization in dealing with health problems.

References

Krug and Quillen. *Living in Our Communities.*
Turner. *Personal and Community Health.*
Wheat and Fitzpatrick. *Health and Body Building.*
Williams. *Healthful Living.*

Films

City-Water Supply. 11 minutes, sound. Encyclopaedia Britannica.
Defending the City's Health. 15 minutes, sound. Encyclopaedia Britannica.

27. *YOU HAVE A PART IN PUBLIC HEALTH*

PUBLIC health concerns itself with the welfare of all the people. Health agencies, both public and private, have been organized to carry on programs which deal with the preservation of health. The success of these programs is greatest in a community that responds to them intelligently. Furthermore, the best results from health legislation are secured if a large part of the population is friendly toward it. The mother who is angry because the school dentist advises that her boy's teeth be filled and the shopkeeper who objects to the restrictions of the board of health in withholding a license because his shop is insanitary are individuals who lack a proper social attitude. It is your duty as a citizen to know what can be done to safeguard the health of yourself and others and then to do as much as you can to this end.

Do you know . . .

1. *How public health is related to individual health?*
2. *What is the work of the United States Public Health Service?*
3. *Why the Federal government cannot give complete health protection to its citizens?*
4. *In what ways the Federal government safeguards health?*
5. *To what extent the state safeguards health?*
6. *What some of your city's welfare problems are?*
7. *How the health service in the public schools benefits the child?*
8. *Some nongovernmental welfare agencies?*
9. *What the qualifications of a competent physician are?*
10. *To what extent the physician can be helpful?*
11. *What some of the movements are toward reducing the cost of medical care?*
12. *Why the health of the entire country depends on rural hygiene?*
13. *Why nations should assist one another in protecting public health?*
14. *What Federal bureau is concerned with better nutrition?*
15. *What Federal agency deals with the welfare of children?*

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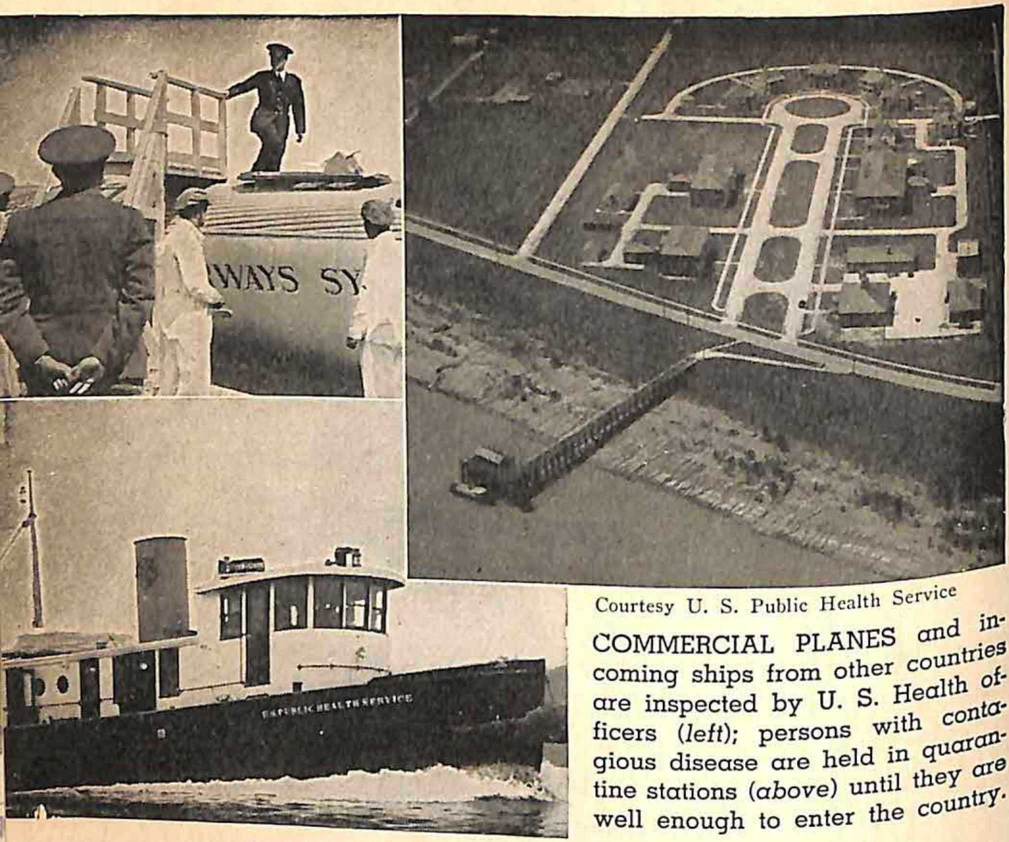


Courtesy U. S. Public Health Service

COMMERCIAL PLANES and incoming ships from other countries are inspected by U. S. Health officers (*left*); persons with contagious disease are held in quarantine stations (*above*) until they are well enough to enter the country.

Public health. The health of the individual is protected: first, by proper personal hygiene; second, by the activities of organized government in disease prevention. Public health service dates back to the end of the 1700's, when steps were taken for providing medical and surgical relief to merchant seamen. Not until after the War Between the States were boards of health established in the principal cities of the United States. A national board of health was created in 1879 but soon died through lack of funds. With the discovery in the latter part of the 1800's of the cause of communicable diseases, efficient health departments began to develop throughout the United States.

The Department of Health, Education, and Welfare. Congress has passed certain laws that protect the health of all citizens throughout the United States. The principal and most important national health agency is the Department of Health, Education, and Welfare organized in April, 1953. It includes the Social Security Administration and the Children's Bureau. The Public Health Service is part of the former agency. It protects citizens from the introduction of diseases by giving medical examinations to all immigrants. If any person is found suffering from disease, he is either quarantined until all danger of spreading the disease is over, or he is returned to his own country. By checking the spread of disease between states, epidemics are suppressed. The United States Public Health Service also co-operates with state and city health departments by furnishing serums, giving advice, and sending out trained workers when necessary. The production and sale of biological products, such as vaccines, antitoxins, and serums, are under Federal control. National health problems are investigated, and information with reference to these studies and surveys is made available. Campaigns for education in public health are sponsored by this service.

Other Federal health agencies. In addition to the United States Public Health Service, there are about twenty-four other agencies in the Federal government, each dealing with some aspect of public health.

The Children's Bureau is responsible for preparing studies and reports upon all matters pertaining to the welfare of children, such as daytime care of children for working mothers, infant mortality, the birth rate, and the diseases of children. It promotes the protection of maternity and infancy, and co-operates with state and municipal agencies in protecting the welfare of the growing child. This bureau has done effective work in bringing to public attention the importance of child hygiene. It publishes bulletins, many of which are sent free to the general public, on the mental and physical health of children. The pamphlets dealing with prenatal care, infant welfare, and mental health of children are especially valuable to mothers.

The Division of Vital Statistics, Bureau of the Census, Department of Commerce, publishes annually birth and death statistics from states and municipalities. It is endeavoring to promote adequate registration of births and deaths in all localities. The collection of vital statistics in any given community is not up to standard if it does not record at least 90 percent of births and 90 percent of deaths. At irregular intervals, and every ten years, other publications on vital statistics appear, including such records as the causes of death rates at various ages.

The Division of School Hygiene in the Office of Education is concerned with healthful environment and with the physical and mental development of school children. Surveys of school systems are made and bulletins on teaching health to children are published.

The Food and Drug Administration in the Social Security Administration administers the food and drug laws. The Pure Food and Drugs Act, passed in 1906, provided that the manufacturer guarantee the goods to be what the label says they are. Since the passage of this law, many products not dealt with in it have arisen. To better fit these conditions, a new law (see p. 358) was passed in 1938 which extended the scope of the Pure Food and Drugs Act to include cosmetics, therapeutic devices, and several drugs which were not under Federal legislation.

The Bureau of Entomology and Plant Quarantine and the Bureau of Animal Industry, Department of Agriculture, investigate diseases of animals, many of which have a direct relationship to human disease. Insects that affect the health of crops and animals, and incidentally the health of man, are studied by the Biological Survey. The Bureau of Human Nutrition and Home Economics is bringing about better nutrition of children through practical demonstrations of food and the publication of educational literature.

The Post Office Department has charge of violations of the law prohibiting the sending of fraudulent advertising through the mail. This has been most useful in suppressing the sale of remedies marketed under false claims.

Safeguarding the health of the state. There are health problems in one state or in one section of the country that differ greatly from those of other states in the union. Each state is responsible for its health conditions and the Federal government cannot interfere in those matters which affect only the state itself. In any

Courtesy Ewing Galloway

THE WARNING SIGN! Regulations governing contagious diseases are designed to protect community health and should be observed honestly and diligently.

emergency, however, the Federal government stands ready to help. In serious epidemics in any state, the United States Public Health Service usually offers its services to help combat the disease, working with state and local authorities. State health departments establish state-wide sanitary codes. These relate to the prevention of communicable diseases, the spread of knowledge regarding health matters, study and prevention of infant mortality, and promotion of the health of the school child. The state department also makes certain types of laboratory examinations for physicians, takes means to prevent the pollution of drinking water supplies, and institutes general regulations concerning the control of communicable diseases.

Rural hygiene. The health of the country as a whole depends on rural hygiene. Disease may be brought to cities in milk and vegetables which come from rural districts. Most city water supplies originate in the country. Frequent and extensive travel between city and country makes it difficult to control communicable diseases in the city if the health of the rural population is not fully supervised. The recent emphasis on full-time paid county health officers is due to realization of the importance of rural hygiene. Some states have such an officer for each county.

Safeguarding the health of the city. The public health work of any modern city involves many activities. Most of these center about the city health department. One of its most important activities is to control communicable diseases by enforcing quarantine regulations and by insisting upon inoculation against such diseases as smallpox, typhoid fever, and diphtheria. It also takes measures to prevent the pollution of drinking-water supplies. The health department supervises the inspection of dairies, bakeries, restaurants, cold storage plants, ice cream factories, slaughter houses, packing plants, and stores selling candy, groceries, meats, fish, fruits, and vegetables. It restricts the manufacture and sale of drugs. It attempts to eliminate flies, mosquitoes, and rats, to prevent the use of common drinking cups and common towels in public places, and to correct smoke and dust nuisances. It controls transportation of garbage, rubbish, and ashes. It may also enforce regulations regarding the ventilating, heating, and lighting of buildings, especially tenement houses. It may conduct and supervise clinics for tuberculosis, child welfare, and for the care and treatment of eyes and teeth. In some cities the health department controls the city hospital, particularly if the hospital is concerned with the care of persons having communicable diseases.

There should be a scientific laboratory in connection with the health department. Here cultures coming from sick persons can be examined to detect the presence of such diseases as diphtheria and typhoid fever; and medicines, vaccines, and serums can be tested.

The health department keeps records of births, marriages, and deaths. It gives out information concerning health and proper methods of living through bulletins, demonstrations, and public lectures. The police department co-operates whenever necessary to enforce the laws and regulations. The board of education provides means of giving information to children concerning healthful living.

Public health and the Social Security Act. The Social Security Act of 1935 includes certain provisions for public health which

Courtesy Denver Community Chest

YOUNG MOTHERS take their babies to the city health centers to be carefully examined, measured, and weighed. A record is kept of each child's growth. Each mother is told about the best foods and clothing for her infant and the way to train the child in good health habits.

relate particularly to the blind and to maternal and child welfare. Allotment of funds for developing and maintaining state and local health services is to be made to the individual states on the basis of population, special health problems, and financial needs. The act also provides for an appropriation for additional work by the United States Public Health Service. Federal assistance is given to school districts so that adequate lunches may be provided for children. Such lunches must meet certain nutritional standards and be sold at designated prices.

Courtesy Denver Public Schools

THE SCHOOL physician makes a thorough examination of children, and a record is kept on file for each child.

Health service for the school child. This is an important phase of the school health program. It should provide for medical examination of school children, follow-up work for correction of defects, improvements in school sanitation, and provisions for the safety of children. In many cities nutrition work is carried on, involving the actual feeding of undernourished children.

The school physician should make annually at least one thorough examination of each pupil that is not cared for by the family physician, and should examine individual pupils again during the year as need arises. Recommendations are sent to the parents regarding needed corrections of defects, and suggestions are made that the children consult the family physician. Usually the school physician may exclude children from school if there are symptoms of contagious disease.

The school dentist usually examines each child at regular intervals. In some school systems, the dentist merely recommends corrections to parents, these corrections to be made by the family dentist. In other school systems, he makes all corrections, or he corrects and repairs teeth only for those children whose parents are unable to pay for the service.

The school nurse is under the direction of the school physician. She visits each school daily to examine pupils whom the teacher suspects of being ill. The nurse also does follow-up work in the home. After the parents have received notes from the physician or dentist, she tries to obtain a volunteer promise of the parents that the corrections will be made. She may also carry on an educational program, giving lectures, demonstrations, and individual conferences concerning personal and community health.

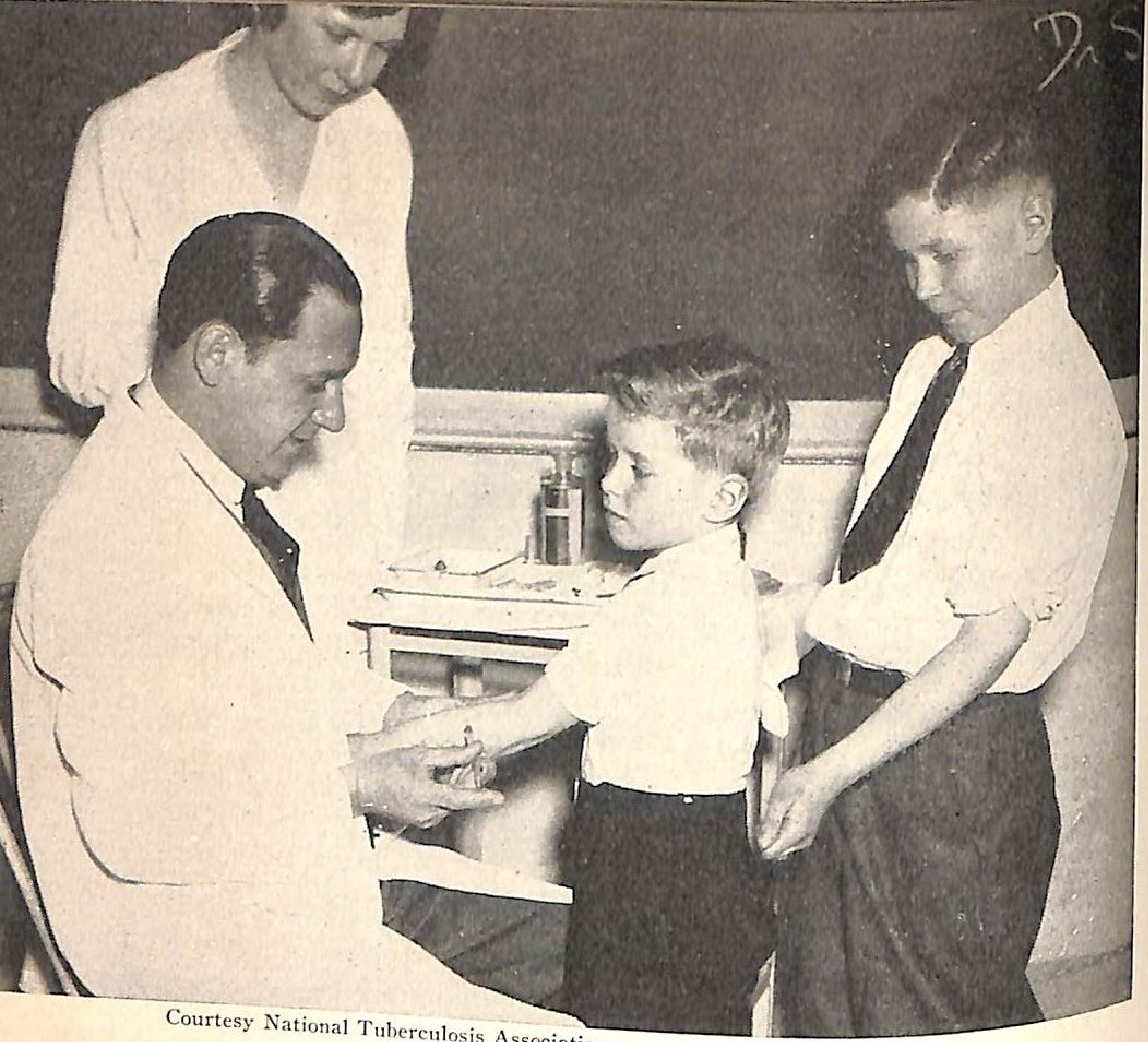
Courtesy U. S. Public Health Service

THOSE CHILDREN who cannot afford the services of a private dentist are referred by the school nurse to a dental clinic.

Organizations concerned with public health. There are many private organizations and institutions which carry on excellent welfare work. Among these are the American Public Health Association, the American Red Cross, the National Tuberculosis Association, and the American Dental Association.

The American Public Health Association is composed largely of health officials and of teachers of public health in colleges and universities and is the accepted authority on efficient and progressive health practices. This organization carries on research in public hygiene and encourages the adoption of improved methods of protecting citizens against diseases. It publishes pamphlets and books and a monthly journal called the *American Public Health Journal.*

The American Red Cross not only does nursing service in times of war but also does much public health work in times of peace. The public health work is organized in connection with epidemic diseases, and with great floods, fires, and destructive windstorms. It maintains nursing and nutrition services for public schools and for instruction of mothers in the feeding and the care of the child. Since World War I, the local chapters have aided many veterans in obtaining medical aid from the Federal government in cases of injury or disease resulting from service in the war. In World War II, the American Red Cross did valiant service in receiving blood from voluntary donors. Financial support for the American Red Cross comes from its members, each member



Dr S

Courtesy National Tuberculosis Association

THE NATIONAL Tuberculosis Association conducts campaigns to discover unknown cases of tuberculosis. The tuberculin test is a safe and accurate means of finding whether or not tuberculosis germs are present in the body. The test may be made by injecting a drop of germ-free liquid called tuberculin into the skin or by taping a patch containing tuberculin against the skin.

usually paying one dollar annually. In some localities the American Red Cross receives additional financial aid from local organizations such as the Community Chest. The American Junior Red Cross, which operates in our public schools, is a branch of this organization.

The National Tuberculosis Association was organized for the purpose of combating tuberculosis. It carries on its work largely through branch organizations in the various states. It encourages the establishment of special hospitals for the tuberculous, conducts clinics particularly for tuberculous suspects—although not confining its activities to this class of patients only—and educates the public in matters of hygiene through newspapers, pamphlets, and moving pictures. It is supported by the sale of Christmas seals, sometimes improperly called "Red Cross Seals."

The American Dental Association is the national organization for the dental profession. Literature on oral hygiene may be had from this association.

Other organizations that deal with health problems are the National Safety Council, the National Committee for the Prevention of Blindness, the American Society for the Control of Cancer, the National Committee for Mental Hygiene, and the American Social Hygiene Association. Many other organizations—such as life insurance companies, Milbank Foundation—also carry on excellent welfare work.

The American Medical Association. This is the national organization of physicians and surgeons. It maintains a public health section in its annual meetings and publishes much material on public hygiene in its weekly *Journal* and in pamphlets and books. Its work includes the exposure of patent medicine frauds and various kinds of quackery. The association also publishes *Today's Health,* a popular monthly magazine on health.

World health. A low standard of health in any country is a menace to all neighboring countries and to the world at large. Leading nations that enjoy greater advantages and opportunities in health work realize the wisdom of making these advantages available to nations that are backward or that lack financial ability to carry on progressive measures. Various international agreements have been made in recent years so that nations may mutually assist one another in protecting public health. Sixty-one governments formed the World Health Organization in 1946 to extend knowledge and methods developed in advanced countries.

The workers of the World Health Organization, the International Health Board of the Rockefeller Foundation, and other bodies which are interested in international health service through their humanitarian activities, may ultimately bring nations together. The work of these organizations creates a better understanding between nations and increases mutual trust and respect

Courtesy Science Illustrated Magazine

SOME OF the medical research that leads to the greatest benefits for man has been possible because of funds granted by great foundations.

because it touches the health of the people. The world-wide nature of modern commerce and travel increases the danger of the spread of communicable diseases. It is necessary for us to keep informed concerning the prevalence of disease, not only in the United States, but throughout the world.

Within recent years research work has been carried on through the generous aid of a number of foundations or funds. The International Health Board, endorsed by the Rockefeller Foundation, has been dealing with the problem of wiping out yellow fever in all parts of the world. The Rockefeller Institute for Medical Research has cooperated in a world-wide campaign to control hookworm disease and malaria. The Rockefeller Foundation, through its special funds, encourages medical research in other fields and also promotes public health and medical education in various parts of the world.

Health at home. A growing interest in public health is apparent in the attitude of businessmen who are promoting welfare activities in their service and civic clubs. They are helping the underprivileged by fostering the care of the blind and by establishing health clinics and summer camps. In many ways they are influencing public opinion toward providing more adequate community health budgets.

Choosing a physican. Individuals may go on for years before medical advice seems necessary. But the need will arise sooner or later. When it does, from what source shall we seek help?

Shall it be from advertisements that guarantee cures, from a well-intentioned but unscientific friend or neighbor, from a teacher, from a reliable book, or from a physician? Just as we call upon architects and builders to construct our houses, plumbers and engineers to take care of our sanitation, trained dressmakers and tailors to make our clothes, so we should depend upon the physician for expert care of our bodily health.

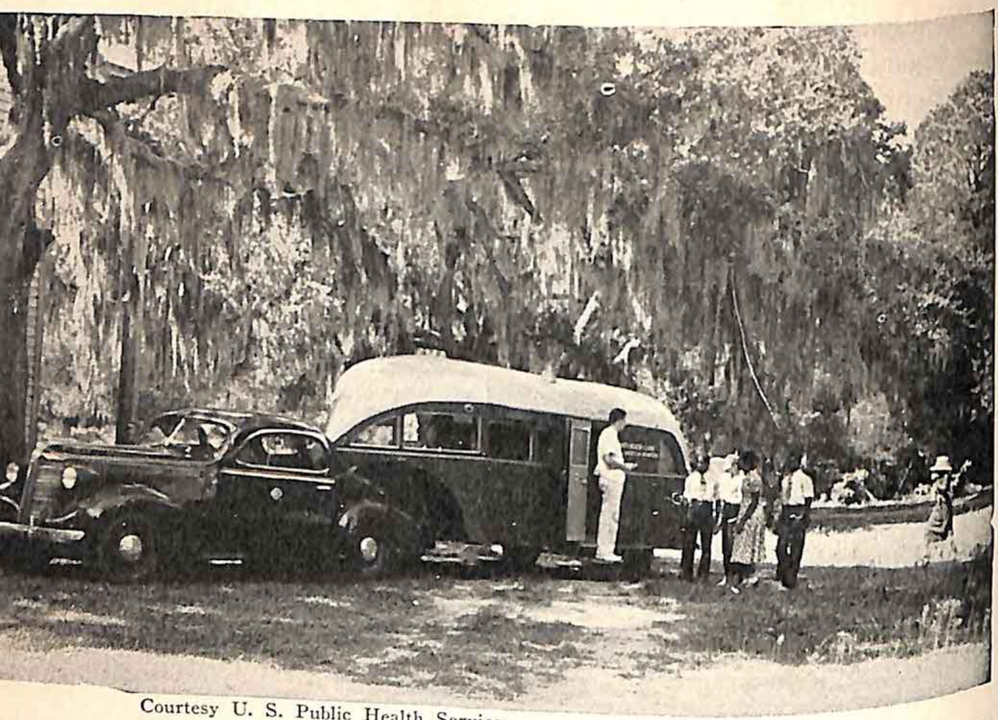
No one fixed rule for selecting a physician can be given. The majority will agree that the physician of one's choice should have thorough training, practical experience, and a personality that inspires confidence. After settling in a community, one should attempt to find such a physician. Information given by discriminating friends or even by a local hospital or medical society will help. But the selection is not always easy.

Certain considerations should be borne in mind in making one's choice. Is the physician well informed on all modern ways of treatment of disease, or does he limit his work to one type of treatment? Is he connected with a good hospital? Does he attend medical meetings to keep abreast of progress in the field of medicine? Does he make careful records of his medical cases? Does he base his diagnosis upon careful study of all possible causes, or does he attribute all illness to one cause?

After a physician has been carefully chosen, his advice should be followed. It must be remembered that the physician cannot perform miracles. Sometimes he can make a direct attack upon an ailment, but often the best he can do is to aid the body in fighting its own battle.

The physician should be a health adviser, as well as one who directly treats ailments. In the annual physical examination, now so much advised, he should take an inventory of the health assets of the individual. Remediable defects may be discovered, and a beneficial routine recommended.

The cost of medical care. There is a general impression that the cost of medical care is excessively high. Yet each year more than twice as much money is spent by the American people for tobacco as is spent for the services of physicians and dentists (see p. 337). Americans spend $350,000,000 annually on patent medi-



Courtesy U. S. Public Health Service

MEDICAL TREATMENT is brought to the rural areas of the South in the modern mobile clinic.

cines and quackery (see chap. 23). The cost of medical care is an important item, and when an illness of long duration comes, or one involving an operation or hospital care, the cost is usually great. Where it is possible, budgeting or systematic saving seems at present to be the businesslike way for most persons or families to provide for the cost of medical and dental care.

Unfortunately, many of our citizens are unable to pay for necessary medical care, while others find difficulty in meeting the medical emergency that calls for exceptionally large financial outlay. Many families which are ordinarily self-supporting shrink from accepting what they regard as charity. It is often argued that the greatest difficulty in obtaining medical care occurs among families of comfortable but moderate means. How to make medical service available to these people, as well as to the rich and the poor, is one of the most urgent economic problems of our time.

Provisions for medical care. Consideration of schemes that are proving more or less successful in various parts of this country may suggest a possible way out. In large cities there are hospitals with clinics and out-patient departments which give free medical examination and treatment. There are in some cities other clinics which have been organized to provide better and more economical care for families of very moderate means. In these clinics the patients are sometimes expected to pay the full cost.

A movement for obtaining good medical service at moderate cost is developing among students at most American colleges. Many educational institutions are located in small towns where private medical facilities are regarded as inadequate. The school authorities have therefore found it necessary to provide their own facilities for taking care of sickness among students, with the result that complete medical service is given to students at low cost. Certain industries also have organized medical departments which make medical service readily available to the worker.

Another solution of the problem may be plans for group health and hospitalization insurance. In such an arrangement, the members of the group pay fixed premiums to provide for the cost of sickness and hospital care, if and when sickness comes. Within limitations which vary with the individual scheme, members may in some instances choose their own physicians.

There is a definite but much disputed trend toward organization of medicine under government control at public expense. This is apparent in the growth in size and number of health department clinics and county and municipal hospitals which are serving more and more people. Will these government agencies continue to expand and assume more responsibilities? Will private medical agencies and unofficial community organizations be able to provide adequate service upon the basis of moderate periodic payments? Or will compulsory state sickness insurance be necessary in order to solve the problem?

In conclusion

IN CHAPTERS 20, 25, and 26, some of the discoveries and advances in the science of medicine and their significance to those who are concerned with the problem of maintaining health were considered. Notwithstanding the marvelous development in knowledge concerning matters of health, too large a proportion of our population still suffers from disabling diseases and preventable defects. One great problem of the future is to bring to all people a more effective use of medical and health knowledge. Many organizations and agencies are headed in this direction, but a very great deal has yet to be done toward closing the gap between scientific knowledge and daily practice.

Activities

1. Report to the class the function of your local board of health.

2. Visit the local headquarters of the National Tuberculosis Association and find out how the organization functions in your community.

3. Make a list of the various health agencies and clinics in your community.

4. Tell what is being done in your own school to check on the health of the students.

5. Visit a hospital or sanatorium and describe the institution. Perhaps you have at some time been a patient and can give a firsthand account of the life there.

6. Report to the class the emergencies during the last five years for which the American Red Cross has offered assistance.

7. What facilities does the Junior Red Cross offer you?

Test

Directions: On a separate sheet of paper write the letters from A to H, corresponding to the letters of the practices given below. Place a check mark (✓) to the left of the letters indicating the practices which you would recommend. To the right of the checked letters, place the numbers for the reasons supporting the practices which you consider true. Do not write in the book.

The firm for which Mr. Brown works has recently transferred him to another city. A few days after the arrival of his family, Mary, one of the children, becomes very ill, suffering from severe abdominal pains. Mr. Brown wants expert medical advice. How should he go about it to get a reliable physician?

A. Look in the classified section of the telephone directory for the address of some institution or individual that advertises a method of cure or treatment for digestive ailments and take Mary to that address.

B. Ask a pharmacist at a large drugstore for advice as to what medicine he should give Mary.

C. Call the city health department and ask them to recommend a doctor.

D. Go to a reputable hospital and ask for a physician trained to treat digestive ailments.

E. Call a local medical association and ask them to recommend a physician.

F. Ask a friend to recommend a doctor he knows to be reliable.

G. Walk along the street until he finds a doctor's office; then consult with the doctor in attendance.

H. Consult the local newspapers for the names of advertising clinics and visit one of them.

1. Most good physicians belong to a recognized medical society.
2. A friend would not knowingly recommend anyone who was not well qualified to treat a specific disorder.
3. Reputable physicians sometimes advertise in local papers, stating their specialty and the prices they charge for treatment and examination.
4. Clinics that advertise their methods of diagnosis and treatment are likely to be less expensive and just as reliable as those who do not advertise.
5. Special systems of treatment have been worked out by some men not in the medical profession that they may safely use in treating some types of disorders.
6. Physicians who have important hospital relationships are likely to be well qualified to diagnose and treat specific disorders.
7. Registered pharmacists in many cases know as much about drugs and should be allowed to prescribe as regular physicians.
8. The state requires that all men using the title "doctor" must be qualified to practice medicine.
9. The city health department is organized for the protection of the health of its citizens and is interested in supplying information to people who are in need of medical care.

Associated subjects

Biology: The economic importance of health and its relation to the work of health agencies—national, international, and private. . . . The contributions made by biologists to the field of medical research. . . . Opportunities for choosing a vocation in the fields of medicine and social welfare.

Physical education: Personal hygiene and the importance of the physical examination.

Social science: The social significance of public health. . . . The work of national and private agencies in promoting health and also legislation that will bring about more adequate health service for all.

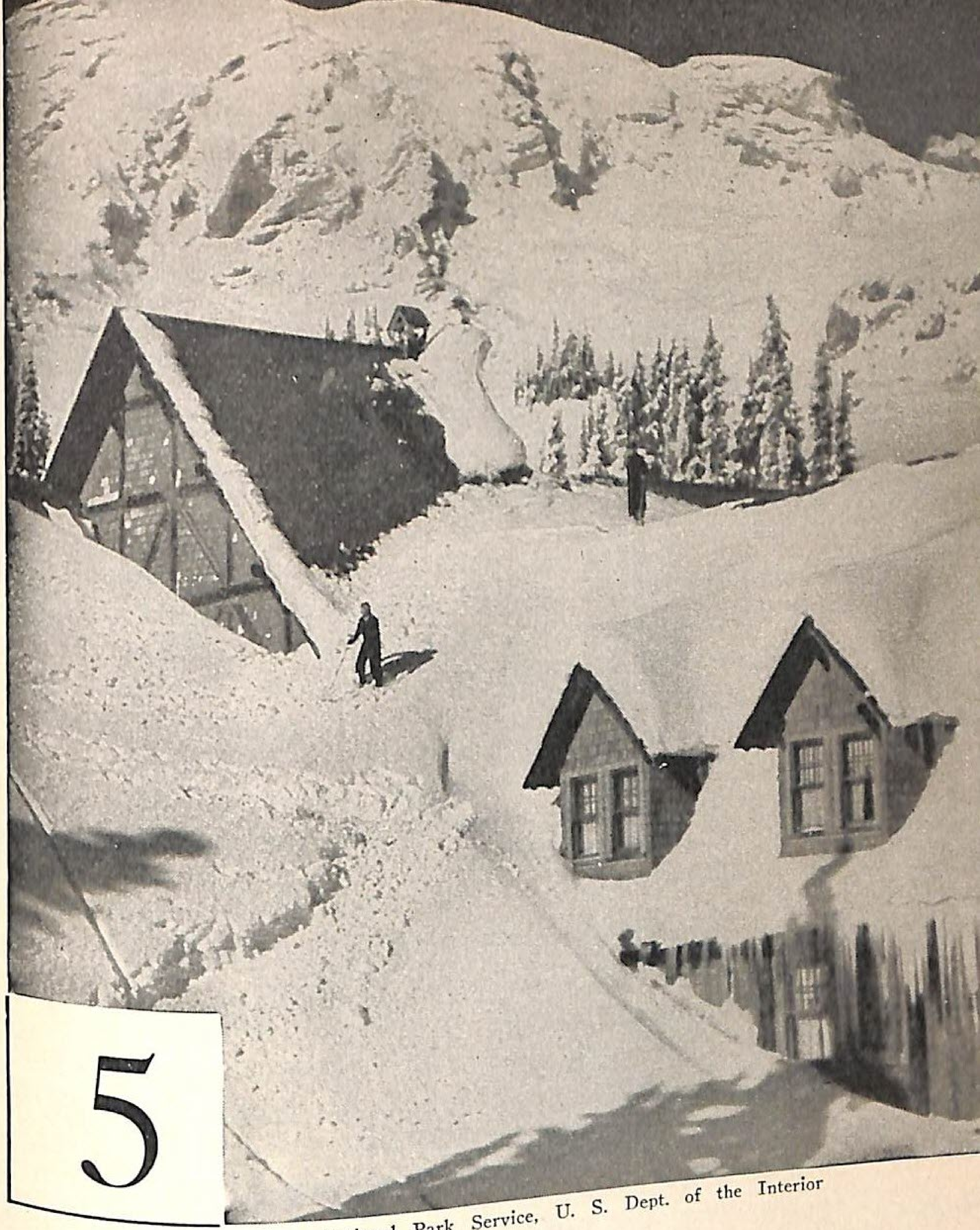
References

CAVINS. *National Health Agencies.*
KRUG and QUILLEN. *Living in Our Communities.*
TURNER. *Personal and Community Health.*
WILLIAMS. *Investing in Your Health.*
WILSON. *Ambassadors in White.*

Films

Magic Bullets. 30 minutes, sound. U. S. Public Health Service.

Three Counties Against Syphilis. 19 minutes, sound. U. S. Public Health Service.



Courtesy National Park Service, U. S. Dept. of the Interior

5

Your Health and Safety

28. YOU MAY HAVE TO KNOW FIRST AID

IN THE home, in the school, and on the street, sudden illness or accidental injuries are certain to occur from time to time. Each person should know something of the early treatment to be given a sick or injured person before the physician arrives. Even an apparently trivial injury may lead to serious complications which might have been avoided by first aid promptly administered and followed by competent medical attention.

Do you know . . .

1. How first aid may reduce the death toll?
2. What should be done when someone faints?
3. What suffocation is?
4. What artificial respiration is?
5. What the treatment is for burns?
6. Why wounds should receive proper first-aid treatment?
7. How a sprain should be treated?
8. Why it is important that broken bones be kept from moving?
9. Why it is important to have a clinical thermometer in the home?
10. How to give first aid to one who has fainted?
11. How long artificial respiration should be continued?
12. How burns are classified?
13. How to care for blisters?
14. What are the indications of an infected wound?
15. How to recognize the poison ivy plant?
16. How to apply first aid to poisoning from poison ivy?
17. How a bruise is caused?
18. How to prepare a splint?
19. What types of bandages are generally used?
20. Which is the most useful type of bandage?
21. How frostbite is caused?
22. What the ordinary symptoms of illness are?
23. How to count the pulse?
24. How to use a clinical thermometer?
25. What articles belong in the medicine chest?

Before the physician arrives. In an accidental emergency, such as excessive bleeding, poisoning, electric shock, or drowning, one needs to act as promptly as possible. If it is not a "hurry" case, one should talk calmly and reassuringly to the person or persons injured and should think clearly about what is to be done. The injured person should be placed in a comfortable position lying down and covered to keep him warm and to prevent further shock. If there is a possibility that the back is injured, the victim should *not* be lifted or moved, for in this way the spinal cord may be macerated or completely cut. No one but a competent physician should lift or move such a sufferer, or irreparable damage may be done.

An unconscious person should never be given anything to drink. The crowd should be kept away. Those who cannot be of service should not loiter at the scene of the accident. The person who calls the physician or ambulance should give definite information concerning the location of the injured person and the cause, nature, and probable extent of the injury. The family of the injured person should also be notified. As soon as the physician arrives, the person who is administering first aid should explain what has been done.

Fainting. This is one of the commonest emergencies. Among various causes, fainting may be brought on by pain, fatigue, want of food, a severe emotional shock (such as sudden fright), or being in a closed or crowded room. When a person faints, he becomes unconscious because there is an insufficient supply of blood in the brain. The face looks pale and the pulse is weak. If a person has fainted, he should be placed flat on his back. The body may be kept warm by covering with blankets or coats to encourage circulation. A hot-water bottle may be used in addition to the covers. As soon as the patient is conscious, he may be given aromatic spirits of ammonia (one teaspoonful to half a glass of water, preferably hot) or hot coffee, tea, or milk. Generally a person who faints regains consciousness in a short time. If he does not soon recover, a physician should be called, as the fainting may be caused by a head injury or it may be the result of a heart condition.

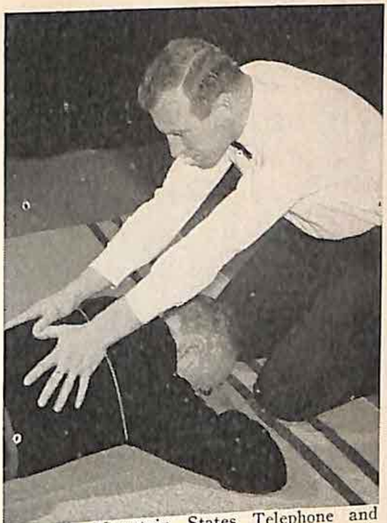
Shock. Shock is a condition in which all the activities of the body are greatly depressed. To some extent it resembles fainting. It may accompany any severe injury, especially if a great deal of bleeding is involved. The skin is cold and wet with perspiration. The pulse is weak and rapid. In severe cases the patient may be unconscious, or he may be confused and feel weak and uncertain of what has happened to him. The shocked person should be placed on his back, and otherwise given the same treatment as for fainting. It is especially important to keep him warm.

Electric shock. Electric shock may be produced by contact with defective wiring. It may also be caused by touching an electric cord or fixture with wet hands or while standing in water. A person who has been struck and knocked down by shock through an electric wire, and is still in contact with the wire, should be let alone, unless one knows how to remove the victim without injury to oneself. If a switch is near, the current should be turned off as quickly as possible; otherwise, the electric company or the police department should be notified immediately. It is always dangerous for one who is not well trained in electrical matters to attempt to rescue a victim from contact with a live wire. The rescuer should be careful not to touch any conducting material. A dry stick, dry board, dry rope, dry leather or rubber glove, or dry woolen article of clothing should be used to remove the wire from the person, or the person from the wire. Artificial respiration should be used if breathing has stopped.

Wires are often found broken after a severe storm. It is exceedingly dangerous to handle, or to come in contact with, any loose electrical wires in the street or alley, whether the wire is dangling from a pole or lying on the ground or sidewalk. The police should be notified of such conditions immediately.

Suffocation. Suffocation is a condition of unconsciousness resulting from inability to get oxygen into the lungs. The lungs may be filled with water, blood, or gas, or the windpipe may be closed by the presence of a foreign body, or the products of infection. Electric shock or a heavy load on the chest or abdomen restricting the breathing process may cause unconsciousness. When breathing stops, artificial respiration should be started at once.

The back pressure—arm lift method of artificial respiration. Open the subject's mouth and see that it is empty. Lay the subject face downward, bend his elbows, and place his hands on top of each other under his head. Turn the subject's face to one side so that the eye rests on a knuckle of the top hand. This will allow the thumbs to hold the mouth and nose off the ground. Kneel at the subject's head, facing toward his feet. Lean over the subject's head and place your hands on his back so that the heels of your hands are just below a line between the subject's armpits. Touch your thumbs over the backbone and spread fingers. Rock forward slowly, with your elbows straight, until your arms are vertical. Allow the weight of your body to exert steady, even pressure upon your hands. This is the compression phase. Release your hands and move them down the subject's arms to his elbows, remaining bent over the subject. Grasp the elbows, then straighten back slowly, drawing the subject's arms upward and toward the operator. Lift subject's arms just enough to feel tension and resistance in his shoulders. This is the expansion phase. Lower the arms to the ground, completing one cycle. Cycles should be repeated twelve times per minute. Each cycle may be timed by saying slowly, "Hands on, swing forward, release, and lift," as the actions are performed. This method gives good exchange of air and can be performed for a long period, if necessary, without undue fatigue.



Courtesy Mountain States Telephone and Telegraph Co. and Denver Chapter American Red Cross

THE BACK PRESSURE—arm lift method of artificial respiration gives the greatest exchange of air.

Artificial respiration should be kept up until the patient begins to breathe, or until there is unquestionable evidence that the heart has stopped beating. When the patient begins to breathe, he

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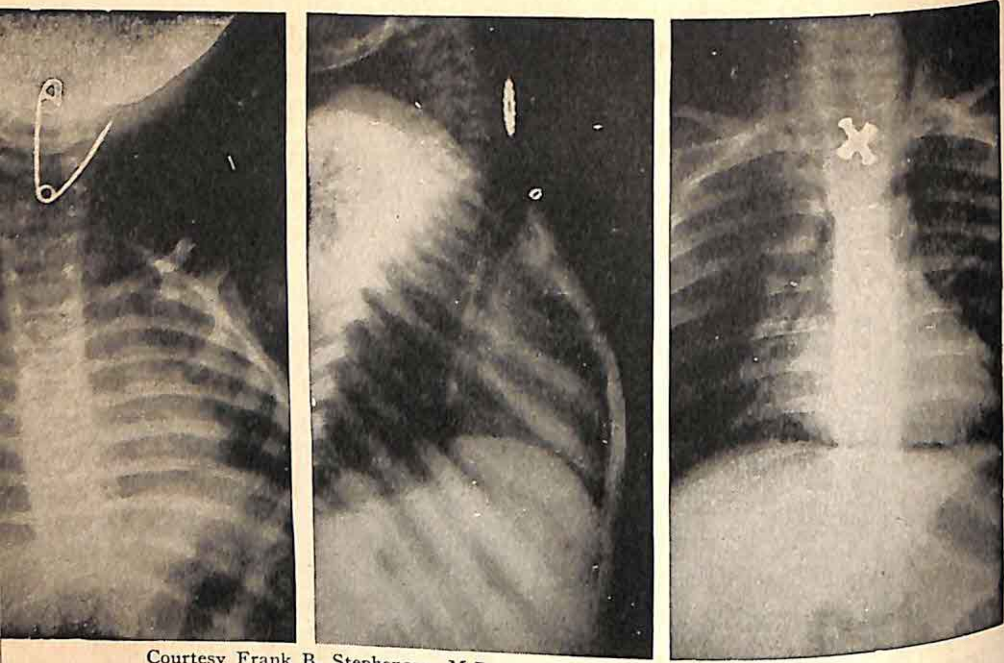


Courtesy Frank B. Stephenson, M.D.

EVERYTHING but clean food and drink should be kept out of the mouth. Children sometimes swallow objects which may cause serious results. These X-ray pictures show objects that have been swallowed by young children and have lodged in the esophagus—a safety pin, a toy cart wheel, and a jack.

should be turned on his back and covered with warm blankets. He should be kept quiet at least two or three hours after resuscitation.

Treating burns and scalds. Injuries from dry heat are called burns and those from moist heat are called scalds. Burns and scalds are classified according to severity: first degree, the skin is reddened; second degree, the skin is blistered; third degree, the deeper tissues are burned or charred. In treating burns and scalds, it should be remembered that excluding the air from the injury reduces the pain and that the burn should never be touched with the hands or anything that is not sterile. For the relief of slight burns where the skin is reddened, one may apply olive oil or a paste of baking soda and water. A wet compress, made by moistening a sterile cloth in a solution of baking soda, may be applied to more severe burns. A weak tannic acid solution is sometimes used by physicians. This may be prepared in the home by pouring hot water on tea leaves. It should be kept on the burned area until the physician arrives. The patient should be watched for shock. Oily substances should not be used on severe burns, since they are difficult and painful to remove when the physician starts treatment.

Blisters should never be opened nor punctured. A broken blister is an open wound, and liable to infection. If the burn has been caused by an acid or an alkali, the chemical should be washed off thoroughly with large quantities of water, preferably not too cold, before the burned area is covered with a dressing. Sunburn may be treated in the same way as slight burns (see p. 39).

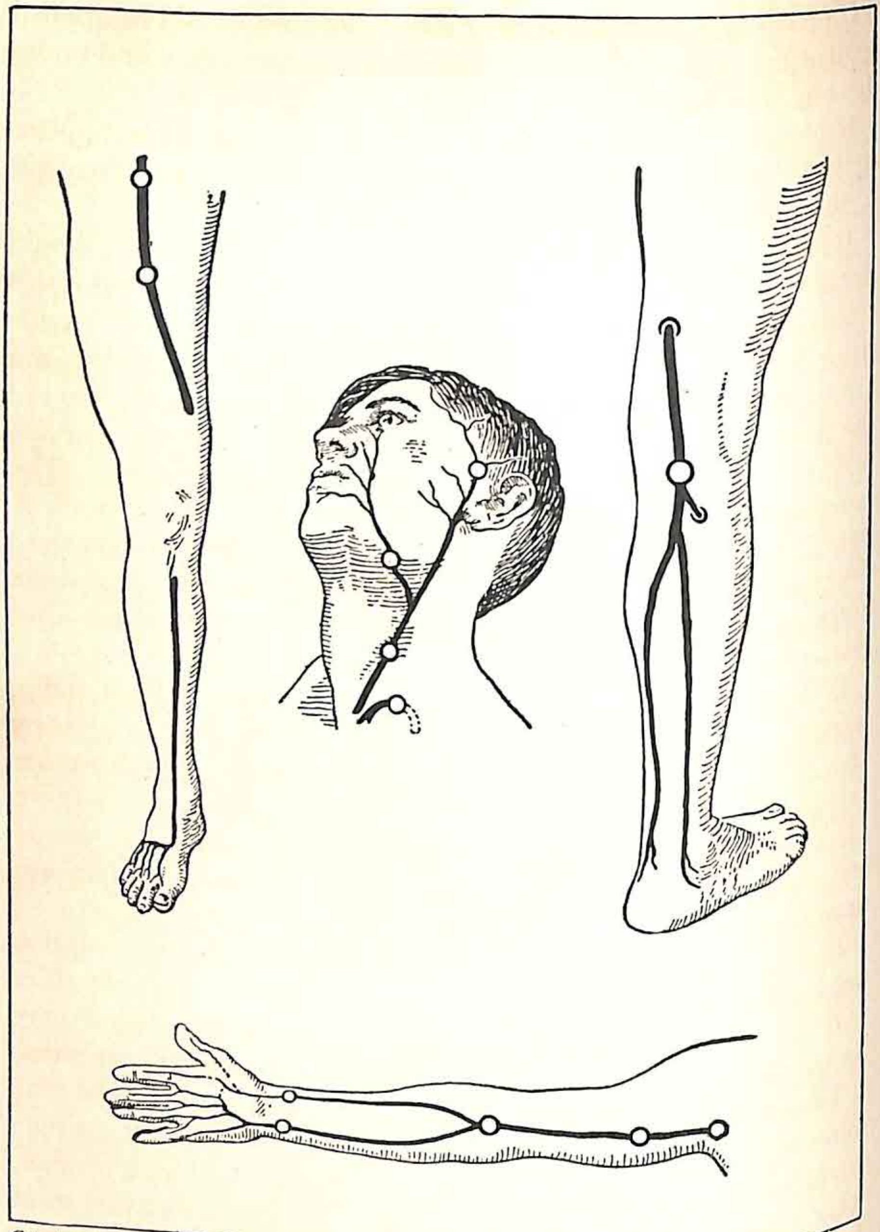
Wounds. A wound is a break in the skin or in the mucous membrane lining of one of the body cavities. The two chief dangers from wounds are bleeding and infection.

When bleeding is severe, one should think first of applying pressure. Enough clothing should be removed (cut away, if necessary) so that the wound may be clearly seen. Blood from an artery will come in spurts, except when the cut artery is deep in the flesh, in which case the blood may appear to flow as a steady stream. If the blood flows steadily, it is usually from a vein; if it merely oozes, it is probably from a network of tiny vessels. The blood should be shut off by placing pressure with the fingers or hand on the side from which it is coming: in arterial bleeding, on the side of the wound nearer the heart.

The pressure points to control bleeding from arteries are shown in the illustration on page 468.

If bleeding is from a *neck* wound, the fingers should be placed below the wound against the side of the windpipe and the thumb carried on around the back of the neck. Then bringing the ends of the fingers toward the thumb, the cut blood vessel should be pressed against the spinal column.

If bleeding is from the *shoulder*, the thumb should be pressed into the V-shaped hollow just above and behind the center of the collarbone.



Courtesy U. S. Bureau of Mines

IN ALL serious bleeding, it is important to apply pressure with the finger where the main arteries lie close to the bone. These places are in front of the *ear*, along the *jawbone*, the side of the *windpipe*, behind the *collarbone*, inside the *arm*, and in the *groin*.

If bleeding is from the *arm* or *hand,* pressure should be applied against the bone of the upper arm at about the middle and under the big arm muscle.

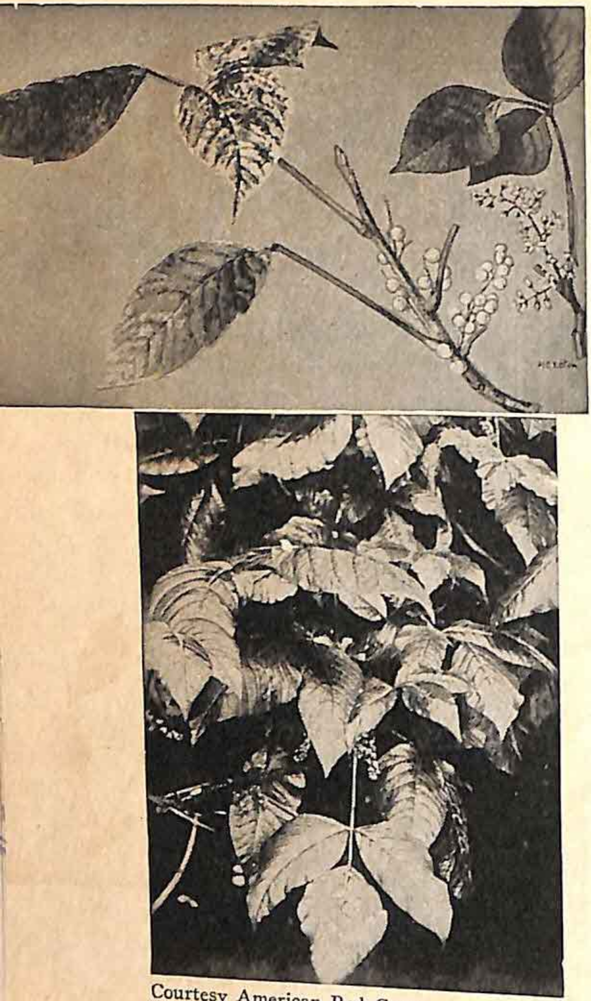
If bleeding is from the *leg* or *foot,* pressure should be applied against the thigh bone, about three inches below the inner margin of the hipbone.

If bleeding can be stopped in any other way, a tourniquet should not be used. It cuts off all the blood supply to the part, and if this condition lasts too long, the part dies. A tourniquet may be made from a strong necktie or from a large handkerchief folded into a narrow band. The two ends are tied together tightly around the limb, and a stick is then put in the knot and twisted. In this way, the tourniquet may be tightened until bleeding ceases. The tourniquet should be loosened every fifteen or twenty minutes so that there may be movement of blood through the tissues beyond the injury. So many serious results have followed the use of the tourniquet that the tendency is to dispense with tourniquets altogether in first aid work.

If germs enter a wound, infection may occur. Heat, pain, swelling, redness, the formation of pus, and swelling of near-by glands (in the neck, armpit, or groin) may result. Pus germs are very widely distributed on the skin or on clothing—in fact on everything that one handles. In disinfecting a wound, one should try to remove or kill as many germs in the wound as possible and to prevent more germs from entering.

Bleeding is a great aid in cleansing a wound. If the wound is not inclined to bleed, it should be squeezed gently from the sides without actually touching it. After the wound has bled, it may be disinfected or may simply be covered with a sterile dressing.

Disinfecting the wound. An effective antiseptic may be prepared by adding to a small quantity of tincture of iodine, as purchased from the drugstore, an equal amount of rubbing alcohol. The bottle should be kept corked and the iodine mixture used fresh each time or it may become too concentrated. The iodine must be allowed to dry before being covered, so as to prevent blistering. A *sterile dressing* should then be applied to the wound. This is a dressing in which all germs have been destroyed. In an



Courtesy American Red Cross

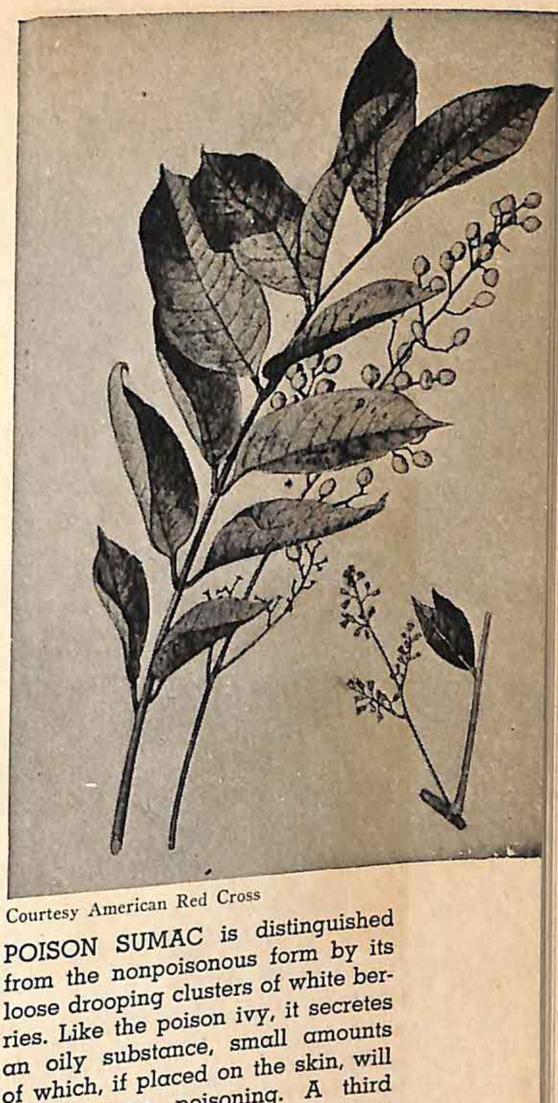
POISON IVY is a trailing plant which can be identified by the three leaflets and the spikes of yellowish-white berries. The leaves are red in early spring and in the fall of the year.

emergency, the inner side of a freshly laundered cloth, such as a towel or handkerchief, may be used. Exposure to the air will not usually infect a wound, so it is better to leave the wound uncovered than to use a nonsterile dressing. Iodine should never be applied to burns or scalds (see p. 466). Before bandaging wounds or attending to any injury of the skin, one's hands should, if possible, be cleaned thoroughly with soap and hot water. Where there is danger that the wound may have been contaminated from the soil, the physician usually injects tetanus antitoxin.

Counteracting poisons. If a poison is taken into the stomach by mistake, every effort should be made to prevent the poison from being absorbed into the body. In most cases the poison should be diluted as quickly as possible by drinking large quantities of water. The patient should then be induced to vomit by being made to drink cupfuls of warm water mixed with dry mustard (a teaspoonful of mustard to a cup of water) until the stomach has been emptied. Warm water and salt, warm soapsuds, or even plain warm water may be substituted for the mustard mixture. This same treatment may be given for food poisoning.

Lastly, Epsom salts should be given so as to drive any remaining poisons and water out of the intestine.

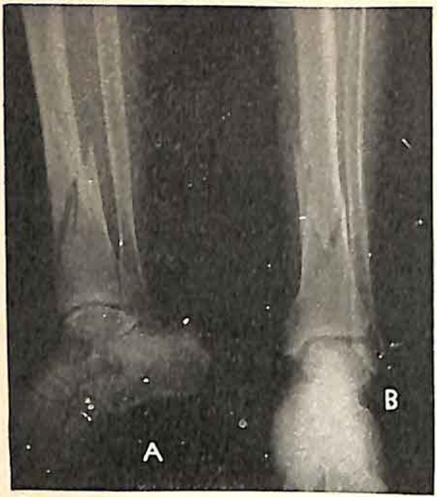
Poison ivy is a creeping or climbing vine found throughout the United States. It may be recognized by its compound leaf, consisting of three parts. In autumn the leaves turn a beautiful crimson color. The poison is a volatile oil which enters the pores of the skin. If the skin has come in contact with poison ivy, one should scrub the exposed portion of the body thoroughly but carefully with a cloth, an alkaline soap—such as yellow laundry soap—under running water, if possible. If running water is not available, several washings, followed by thorough rinsing, should be used. If a rash and itching develop, a thick paste made from laundry soap and water should be applied and left on overnight. Local application of alcohol is also recommended in cases of ivy poisoning, to ease the irritation and to prevent spreading of the poison which is soluble in alcohol.



Courtesy American Red Cross

POISON SUMAC is distinguished from the nonpoisonous form by its loose drooping clusters of white berries. Like the poison ivy, it secretes an oily substance, small amounts of which, if placed on the skin, will cause severe poisoning. A third poisonous member of the same family is the poison oak.

Sprains, strains, and bruises. A sprain is caused by twisting, stretching, or tearing the ligaments about a joint. When a



Courtesy Frank B. Stephenson, M.D.

A BROKEN shinbone (fracture of the tibia) is shown in two views—side (*A*) and front (*B*)—in these X-ray pictures of a leg. Note the position of the fragments. The unbroken fibula fortunately serves as a splint in the case of this fracture.

sprain is slight, the affected part should be elevated so that it will get less blood and should be kept at rest for the first twenty-four hours. This relieves pain and limits the amount of swelling. Either heat or cold or alternate heat and cold may be applied to reduce the swelling. Severe sprains should be treated in the same way until medical attention can be obtained. When in doubt concerning a sprain, it should be treated as a fracture.

A *strain* differs from a sprain in that the muscles and not the ligaments are injured. In addition to resting the injured part, as done for a sprain, light massage (rubbing the limb upward toward the body) is also helpful.

A *bruise* is usually caused by a fall or blow which injures the blood capillaries ("black and blue" marks). Cloths that have been wrung out in very cold water and applied immediately to the injured part may help to reduce the discoloration and keep down the swelling.

Dislocations. Dislocations, usually caused by a fall or by a severe blow, are injuries at the joints in which the ends of the bones are forced out of their normal position. One should not attempt to put the bone back in place but should send for the physician immediately. The patient should be in a comfortable position, and the injured joint should be covered with cloths wrung out in very hot or very cold water to limit swelling.

Fractures. Fracture is another name for a break in a bone. If the broken end of the bone pierces or breaks through the tissues and skin, the fracture is compound; otherwise, it is a simple frac-

Courtesy *Colorado School Journal*, College High School, Greeley

AS A PART of their training in first aid, these girls are learning to apply a traction splint. Much harm can be done to an injured leg or arm if such a splint is not correctly applied.

ture. First aid in treating broken bones should aim to keep the parts undisturbed, especially in the case of a broken or injured back. The patient should be kept from moving until the doctor arrives.

If it is necessary to move the patient, a *splint* should be applied to the injured part to keep the broken ends of bone from moving. Any rigid material, such as a light board or broom handle, that is long enough to reach beyond the joints above and below the break will serve as a splint. The splint should be well padded to fit accurately to the limb and should be applied over the clothing. The softer the padding on the splint, the less is the danger that swelling of the limb will cut off the circulation. The whole length of the splint should then be bandaged securely, but gently, to the broken limb except over the fracture.

Courtesy Denver Public Schools

THESE PUPILS in a first aid class are learning how to use the triangular bandage.

The *American Red Cross First Aid Text-Book* gives the "fixed traction" method as the ideal first-aid treatment for fractures of arm and leg bones. Once traction is started, it should not be released until the splints are in place.

Careless handling of a simple fracture may cause the splintered ends of the broken bone to cut through the tissues and skin, thus making the fracture compound.

Bandaging. Bandages are generally made of muslin or gauze. There are two principal kinds—the roller or pleated gauze bandage and the triangular bandage. They may serve to hold a dressing in place, to support a part, or to exert pressure.

The roller or pleated gauze bandages are strips of gauze rolled into tight rolls or folded (pleated) for convenient packing. The most commonly used widths are 1-inch, 2-inch, and 4-inch, and the length is usually five or ten yards. This kind of bandage is used extensively by the surgeon, but, except for use on fingers and toes, it is not a very good first-aid bandage.

The triangular bandage is the most useful of all bandages for first-aid work. It stays on well without adhesive tape, and can be made easily from any kind of cloth, such as a piece of old sheet or a large handkerchief. The bandage is usually made by cutting a piece of unbleached muslin, 36 to 40 inches square, diagonally into two pieces. The triangular bandage is especially useful to envelope a hand or foot in case of an extensive burn or mangling injury. When folded repeatedly on itself so as to make a strip about four inches wide, it becomes a "cravat" bandage and serves for holding dressings in place about the head. The triangular bandage also makes an excellent sling or a good tourniquet.

Nosebleed. Ordinary bleeding from the nose is harmless. If bleeding continues, pressing the nostrils firmly together for at least four or five minutes will permit a clot to form. The patient should sit up with the head thrown slightly back, breathing through the mouth. Blowing the nose should be avoided for a few hours after the bleeding has stopped. If bleeding is profuse or persistent, a physician should be called. During the period of waiting, the nostril can be packed with a narrow strip of sterile gauze or a wad of cotton. A little of the gauze or cotton should be left outside so that the plug can be removed easily. A pencil or match can be used to insert the pack.

Frostbite. The nose, cheeks, ears, toes, and fingers are the parts of the body most frequently frosted when exposed to low temperatures. To prevent frostbite, one should wear sufficient clothing and should especially avoid undue exposure when exhausted or ill. If a part of the body becomes very cold, place it in contact with a warm skin surface or stimulate circulation by rubbing it.

After the part has become frozen, rubbing is dangerous. Rubbing with snow is especially harmful. The frozen part should be covered gently with the hand or other body surface until circulation is re-established. Exposure of the part to heat should be avoided.

Other common emergencies. When *toothache* occurs during the daytime, one should visit a dentist. If one cannot reach a dentist, first aid may be necessary. In the case of a cavity in the tooth, it should be cleaned with a small bit of cotton wrapped around the end of a toothpick. Then oil of cloves should be applied to the cavity by means of a small piece of cotton on the end of a toothpick. Toothache may sometimes be relieved by hot or cold applications on the outside of the jaw.

The pain from a *sty* (see p. 123) may be lessened and the formation of pus hastened by using compresses wet with water as hot as can be borne comfortably. When pus forms, the sty should be opened by a physician. The treatment of *boils* is discussed on page 48, of *sunburn* on page 39, and of *foreign bodies* in the eye on page 116.

Insect bites often cause irritation, swelling, and inflammation and may be quite painful. Infection frequently occurs from scratching the bite. If the "sting" of the insect is present, it should be removed. A paste made of baking soda or a compress moistened with ammonia water will give relief. The itching of the bite of a mosquito or chigger may be relieved by calamine lotion.

Symptoms of illness. Certain indications of sickness help one to decide whether or not to send for a doctor. The ordinary person can learn to recognize some important symptoms, but only an expert should attempt to diagnose them. Calling attention to symptoms may tend to trouble a patient unduly. Therefore he should be observed as far as possible without his knowledge. Changes in body temperature and pulse rate and the condition of the tongue are objective symptoms that one can learn to recognize.

Every home should have a clinical thermometer, since temperature cannot be estimated by feeling the forehead or the hands of a sick person. Before taking the temperature, the thermometer should be shaken with a quick, jerking motion until the mercury stands below 95 degrees. It should then be rinsed in cold water and placed in the patient's mouth, well under the tongue. The lips are then kept closed, and the thermometer left in place from two to three minutes. Normal temperature is 98.6 degrees Fahrenheit. The thermometer should be washed with cold water and soap and wiped with a clean, soft cloth before it is put away.

To take the pulse, the tips of two fingers (not the thumb) of one hand should be placed along the thumb side of the front of the wrist. The blood will be felt pulsating through the artery underneath. It is best to count the pulse for half a minute, multiply the result by two to get the rate for a whole minute, and then repeat for another half minute. The two results should agree within two beats. The pulse rate varies in different individuals, at different ages, and under varying conditions. It is highest at birth and lowest in old age. Exercise, eating, or excitement may modify the rate. The pulse rate of a normal man at rest is about seventy-two beats a minute and of a normal woman, about eighty. A little practice is necessary before the pulse rate can be counted accurately.

The tongue in health is red and moist. When extended, it is somewhat pointed and can be held steady. In sickness it may be cracked, dry, and parched, or it may be covered with a white, yellow, or brown coating. The odor of the breath may be foul from decay or neglect of the teeth, or from indigestion, constipation, nasal catarrh, or other disease.

The medicine chest. A well-equipped medicine chest should contain the following:

8 oz. castor oil 8 oz. Epsom salts	*Cathartics*: Dose as directed by physician.
Cascara sagrada tablets	*Laxative*: For danger of laxatives see page 352.
Oil of cloves 2 oz. aromatic spirits of ammonia	*Stimulant*: For smelling, place on handkerchief; for internal use, one-half to one teaspoonful to a quarter of a glass of water.
1 oz. tincture of iodine (2%) or individual ampoules (Labeled "Poison")	*Germicide*: Paint injured part lightly only once.

6 oz. rubbing alcohol	*Disinfectant*: 50 to 70 percent solution.
4 oz. boric acid	*Antiseptic*: Two teaspoonfuls to a glass of boiling water. Let cool. Always make fresh.
Common salt	*Toothwash, gargle*: One-half teaspoonful to a cup of warm water. Let cool. Make fresh each time.
1-oz. tube carbolated vaseline 1-oz. tube tannic-acid jelly Olive oil	*Ointments*: For burns, scalds, blisters.
4 oz. baking soda	*Indigestion*: One-half teaspoonful to a glass of warm water.
Mustard, powdered	*Emetic* and *counterirritant*: In mustard plaster, one part mustard and three parts flour, with water to make a thick paste.

Miscellaneous:

6 one-inch gauze compresses on adhesive backing
2 three-inch bandage compresses
Adhesive tape (half-inch and two-inch widths)—One five-yard roll of each
Sterile cotton—One quarter-pound package
Sterile gauze—One square yard
One two-inch roller bandage
Blunt-pointed scissors
Safety pins
Glass medicine dropper (always sterilize before using)
Teaspoon
Clinical thermometer
Hot-water bottle
Safety matches or flashlight
One triangular bandage

Automobile first-aid kit. Each automobile should be provided with a metal box equipped with materials needed in case of accidents. The *American Red Cross First Aid Text-Book* recommends the following minimum content:

Six 1-inch compresses on adhesive
Two 3-inch bandage compresses
One square yard sterile gauze
One triangular bandage
One tube burn ointment, such as 5% tannic-acid jelly
Six iodine ampoules

In conclusion

FIRST aid, as the name implies, is aid given to a person immediately after an injury or an acute attack of illness. It should aim to lessen suffering and to prevent further injury until a physician can be obtained.

However, it is often important to restrain the amateur who is eager to demonstrate his skill. One should not use first-aid procedures unless one is well informed on what is safe and what is not. In an emergency, often what is not done is as important as what is done.

Activities

1. Practice the back pressure—arm lift method of artificial respiration.
2. Practice taking temperatures with a clinical thermometer.
3. Practice taking pulse rates on yourself and others at different times of day and under varying conditions.
4. Make bandages of muslin and of cheesecloth (gauze), and pads and sponges of gauze. Practice putting them on fellow pupils until you can do it neatly. (See *American Red Cross First Aid Text-Book*.)
5. Learn about the "Fixed Traction" treatment of fractures as given in the *American Red Cross First Aid Text-Book*.
6. Practice applying a tourniquet.
7. Clean your home medicine chest and replace old labels on all containers which are kept. Make a list of the medicines which were thrown away and which need to be replaced.

Test

Directions: On a separate sheet of paper write the numbers from 1 to 7, corresponding to the numbers of the reactions given below. Place a check mark (√) to the left of those numbers that you believe indicate the best reactions on the part of the students in the emergency described. To the right of the numbers state the principles upon which you make your selection. Do not write in the book.

Yesterday the biology class visited the natural history museum. After the class had been walking about for an hour, Susan, who had not been feeling very well all morning, fainted.

1. When she fell to the floor, her chum screamed.
2. Two of the boys picked Susan up and laid her down flat on her back where there was a better circulation of air.
3. Another boy took off his coat and used it to cover Susan.
4. One girl found a drinking fountain, wet her handkerchief, and placed it on Susan's forehead.
5. A few of the pupils crowded around to see what aid was being given to Susan.
6. The rest of the class went on with their work.
7. Very soon Susan regained consciousness. One of the members of the class volunteered to take her home in his car.

Associated subjects

Biology: The nature of wounds, burns, sprains, fractures, dislocations, and suffocation, and the bases of their treatment. . . . The principles of infection and sterilization, and the use of antiseptics and germicides. . . . Action of the diaphragm.

Chemistry: Chemicals that serve as antiseptics and germicides, and the action of poisons, including carbon monoxide. . . . Dangers resulting from careless use of explosives and harmful chemicals.

Home economics: Home nursing and care of the sick. . . . The use of the clinical thermometer.

Physical education: First-aid treatment, including artificial respiration.

Physics: Air pressure. . . . Conductivity of substances. . . . Effects of electricity.

References

American Red Cross First Aid Text-Book.
American Red Cross Textbook on Home Nursing.
ARMSTRONG. *What to Do Till the Doctor Comes.*
BRIGGS. *Home Nursing with Confidence.*

First Aid Reminders. National Safety Council.
FISHBEIN and IRWIN. *Health and First Aid*.
Injuries in the Home and on the Farm. American National Red Cross.
Ivy and Sumac Poisoning. U. S. Public Health Service.
WILLIAMS. *Healthful Living*.
WILSON, BRACKEN, and ALMACK. *Life and Health*.

Films

Artificial Respiration. 12 minutes, sound. American National Red Cross.
First Aid. 11 minutes, sound. Encyclopaedia Britannica.
Help Wanted. 26 minutes, sound. Brandon.
How to Control Bleeding. 12 minutes, sound. American National Red Cross.
Life Saving. 20 minutes, sound. U. S. Department of Agriculture.

29 THE ACCIDENT TOLL CAN BE REDUCED

EVERYWHERE the possibility of an accident is before us. Whenever we are thoughtless or in too great a hurry, we run an unnecessary risk.

The National Safety Council states that in 1951, in the United States, 94,000 persons were killed and more than 9,400,000 were seriously injured by accidents. This means that one out of every fourteen persons suffered a disabling injury. Traffic accidents caused over one-third of the fatalities. The cost of all accidents amounted to $7,900,000,000 or more than $250 per second.

This loss of life, and this enormous mass of physical disablement, are particularly shocking because most of the accidents could have been prevented. Accidents do not merely happen. There is a cause for every accident.

Do you know . . .

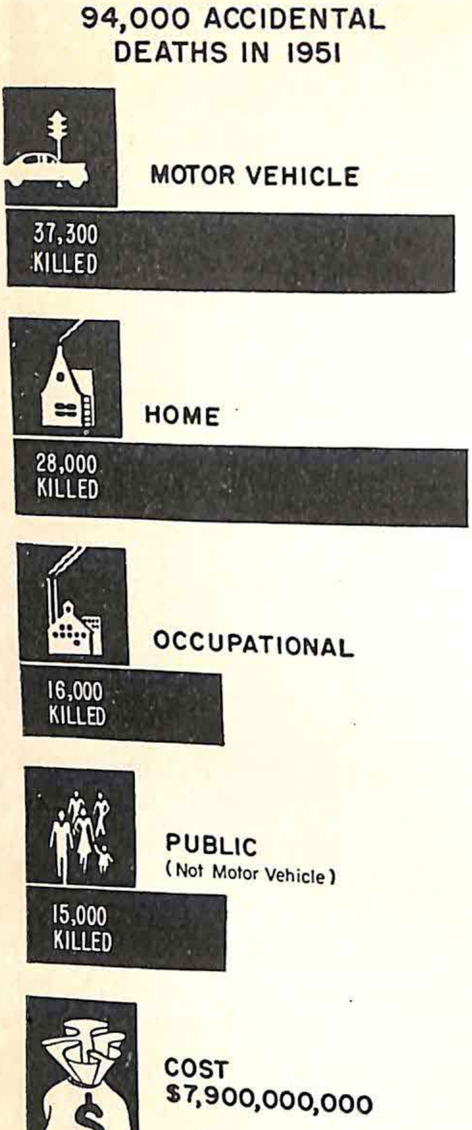
1. What causes so many accidents?
2. How automobile accidents are caused?
3. Why the mental attitude of a person is important in preventing accidents?
4. What the characteristics are of a safe driver?
5. How the pedestrian can help in maintaining safety?
6. How the bicyclist may be a menace to safety?
7. What kind of accidents occur outside the home?
8. Under what conditions most automobile accidents occur?
9. Some of the causes of poor driving?
10. What physical laws govern the speed of an automobile?
11. Why a physical examination should be required of each automobile driver?
12. Why ability to concentrate is important in an automobile driver?
13. Some of the good practices of a pedestrian?
14. From which side of the car one should leave an automobile?
15. On which side of the road a pedestrian should walk?
16. What precautions should be observed in getting off a streetcar?
17. That the bicyclist has the same responsibilities as the automobile driver?

Automobile accidents. There is a sharp upward trend in the number of accidents caused by automobiles, although there is a gradual downward trend in the total number of accidents. The automobile is responsible for approximately one-third of all accidental deaths. Out of 200,000 automobile accidents that were investigated, four-fifths had occurred when the weather was clear and the road dry, and three-fifths during the daytime. Although there are more accidents during daylight, the accidents at night are, on the average, more serious than those in the daytime. Night accidents are also much more frequent in proportion to the amount of traffic. Investigation shows that life is endangered most frequently by excessive speed, reckless driving, cutting in, using the wrong side of the road, or insisting on the right of way.

The science and art of driving. One of the ways, and perhaps the most important, of making traffic safe is to improve the quality of driving. Many high school students are driving cars, and many more expect to be driving soon. The handling of an automobile should be something more than a lark and a thrill. One should aim to become a safe driver through training in the mechanics of driving as well as in actual driving.

The automobile is not a toy but a machine of tremendous power. One will appreciate the power of the car when he understands the physical laws controlling force, speed, and friction. The stopping distance of a car and the force of impact increase with the speed. A little extra speed adds tremendously to the power of the car to do damage. More "clear distance ahead" is required for passing others cars than is generally realized. Momentum tends to keep the car going in the same straight line. When rounding a curve, the direction must be changed. Momentum working against one's effort to turn becomes centrifugal force. This tends to cause side-sway, skidding, and in some instances complete overturning of the car. Centrifugal force varies with the weight and speed of the car, with the position of the center of gravity, with the radius of the curve, and with the degree of "banking" of the road. The driver has control over only one factor, the speed of the car.

Safe driving. Upon the person behind the steering wheel rests the major responsibility for automobile accidents. Too many



From *Accident Facts*, 1952. Courtesy National Safety Council

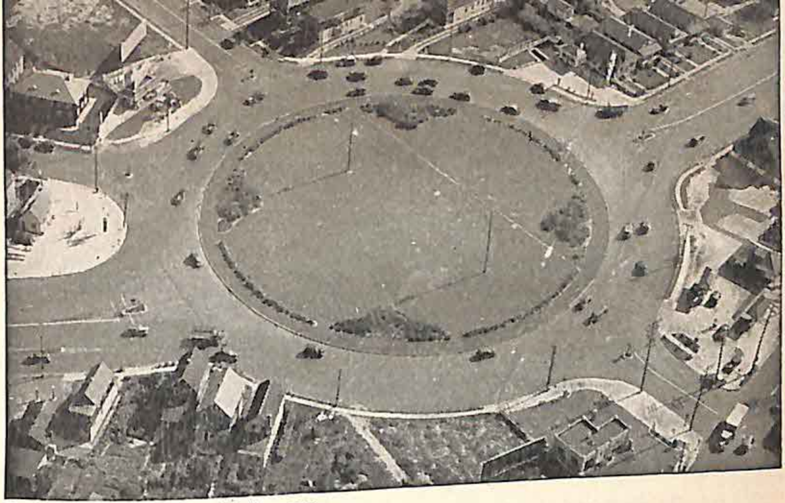
SAFETY CAMPAIGNS have reduced the total number of motor vehicle accidents from 40,000 in 1941. When people try, accidents rates are lower.

drivers have had no formal training in the art of driving. They are familiar with only a few fundamentals of operating a car.

The driver must first learn to make the muscular adjustments involved in the mechanical operation of the car. The movements necessary in starting the engine, shifting gears, using the accelerator and the clutch, steering, and applying the brakes must become automatic. Only through practice over a period of time will these skills become firmly established in the nervous system of the driver.

The automobile should be kept in good running order through periodic inspection of all parts and particularly the safety equipment. This includes the lights, the brakes for correct adjustment, the steering wheel for excessive play, and the condition and correct inflation of the tires.

Sound health, clear vision, and good hearing are important in safe driving. If the driver is physically fit, and his reactions are steady and



Courtesy Fairchild Aerial Surveys

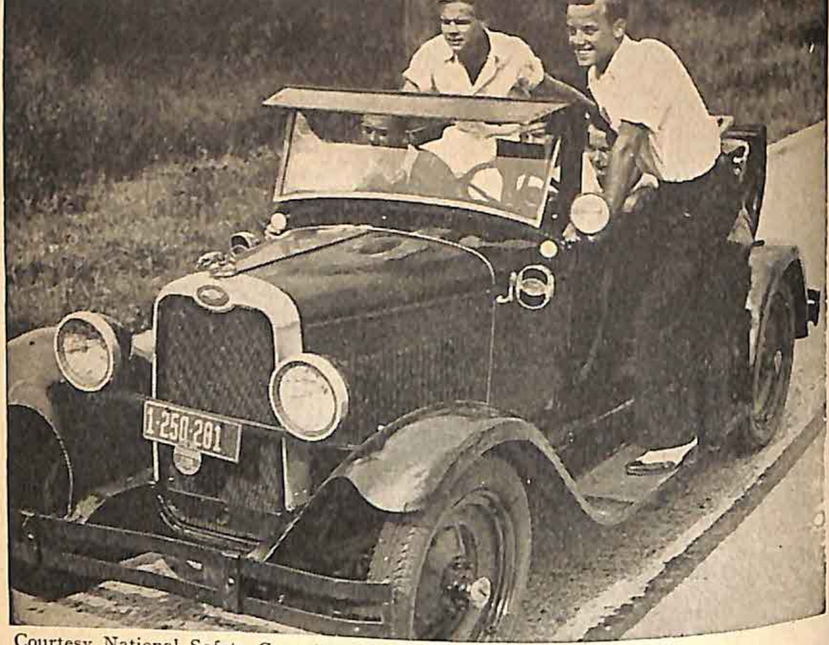
MODERN ROTARY intersections aid motorists in avoiding accidents at road crossings. Automobiles from any number of streets drive slowly to the right around a circular park and turn off into other streets.

his driving performance is more likely to be reliable. The physical condition of the body changes from day to day and so the reaction time of the driver varies.

A driver may become incapacitated through fatigue and poisoning. Night driving, eyestrain, insufficient rest, and carbon monoxide gas may bring on drowsiness and fatigue. Alcohol, even in small amounts (see p. 340), slows down the mental faculties and makes driving unsafe.

While driving, there must be constant attention to the car, to the road, to the immediate traffic conditions, and to looking out for pedestrians. Unless the driver can control his own attention, he cannot control the car. Some of the details that may distract him are rattles in the car, unusual noises, light reflections, his hat blowing off, a bee or wasp in the car, a new car passing by, or even the radio. Conversations, arguments, and back-seat drivers may cause distracting irritations. The driver must control his attention in spite of such possible distractions.

The safe driver is able to judge speed and distances and to react quickly to emergencies. He obeys signs and signals and keeps the car under control and within speed limits. He signals cor-


Courtesy National Safety Council

A FAVORITE STUNT of high school boys is to pack themselves into an old car. This is unsafe and against the law. It obstructs the driver's vision and distracts his attention.

rectly for every turn and for any intention to pull out from the curb, to slow down suddenly, to stop, or to change into another traffic lane. He makes use of the rear-view mirror when about to change his course of travel and glances into it occasionally on the open highway and frequently in city driving. He slows down at unprotected and blind intersections; at blind curves; when approaching the crest of a hill; wherever children are or may be playing; whenever in doubt about road conditions; and, under all conditions, at night. He always sets the hand brake when parking. When parking on a hill, he turns the downhill side of the front wheels against the curb. He starts on time to meet appointments, so as to avoid haste.

Every driver is confronted with certain limitations. The safe driver tries to compensate for these. When driving conditions are unfavorable, he takes special precautions. If physically handicapped, he adjusts his driving to suit his defects. For instance, if partially or totally deaf he must be even more cautious than a person with normal hearing, and must use his eyes more alertly.

Courtesy Denver Tramway Corporation

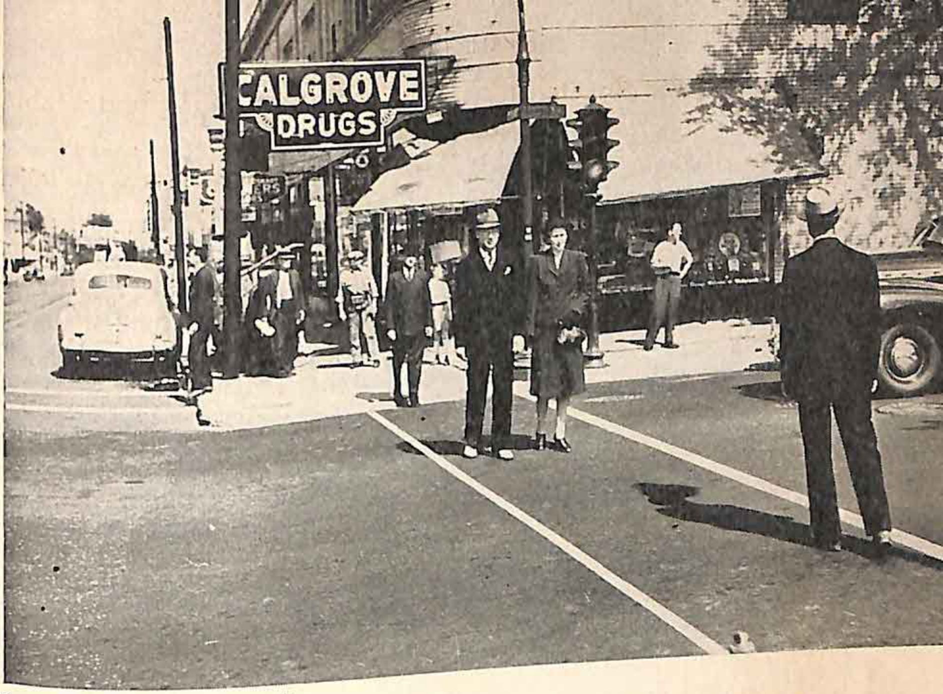
IF DRIVERS would be as courteous when in control of their cars as they usually are in other situations many traffic hazards would be avoided. Patience is needed as well as observance of laws.

Mental attitudes. A large proportion of all highway accidents may be traced to the mental state of the car operators. Refusal to slow down usually results from impatience, overeagerness, and indifference to hazards. There are those who manifest unreasonable annoyance when wanting to pass a slow-moving vehicle. Those who have the "hurry" attitude find it difficult to go at a moderate speed and so take chances by going too fast. Those who like to show off take chances habitually by racing other cars or by disregarding traffic signals. Some drivers become cross and argumentative when discovered in a violation. The driver under the influence of alcohol often becomes a bully, and is always dangerous. Truck drivers may develop boredom from driving too often over the same territory. These are some of the undesirable mental states which interfere with safe driving.

The driver whose mind is free from distraction is able to concentrate on the job in hand. He sees things on the road that others do not see. He slows down at the appearance of mud, gravel, or ice on the concrete. He is conscious of a side road or of the approaching end of the pavement. He adjusts his driving at the sound of a locomotive whistle in the distance. He does not forget the car behind him, and he knows that when the car ahead moves out of line and then slips back again a car is coming in the opposite direction.

Sportsmanship. To be a good loser and a gracious winner shows up on the highway and in places other than the football field. A sportsmanlike driver exhibits fair play and courtesy. He is ready to see and appreciate the problems of others and to make proper allowances for them. He does not take unfair advantage of the mistakes of others. He exercises patience and consideration beyond the actual letter of the law. He lets the other person have the right of way when in doubt. He is particularly watchful of children and other pedestrians. He uses the horn only when necessary to pass a car going in the same direction or to warn pedestrians or children at play who may be in danger. On the other hand, the considerate pedestrian does not annoy the motorist and endanger himself by disregarding signals, stepping in front of a moving car, or walking carelessly on the highway.

The pedestrian. The person walking on the street may be as responsible for accidents as the motorist, or more so. He is subject to the same physical and mental limitations as the driver. Defective eyesight and hearing, slowness to react, and lack of alertness in walking may handicap him. Absent-mindedness, fear, confusion, haste, poor judgment, and ignorance of traffic rules contribute to pedestrian accidents. A few bad practices on the part of the pedestrian are responsible for a majority of the accidents to pedestrians. These are crossing streets in the middle of the block (jaywalking); disregarding traffic lights, warning signs, and traffic policemen at intersections; stepping out from the curb between parked cars; and playing in the streets.



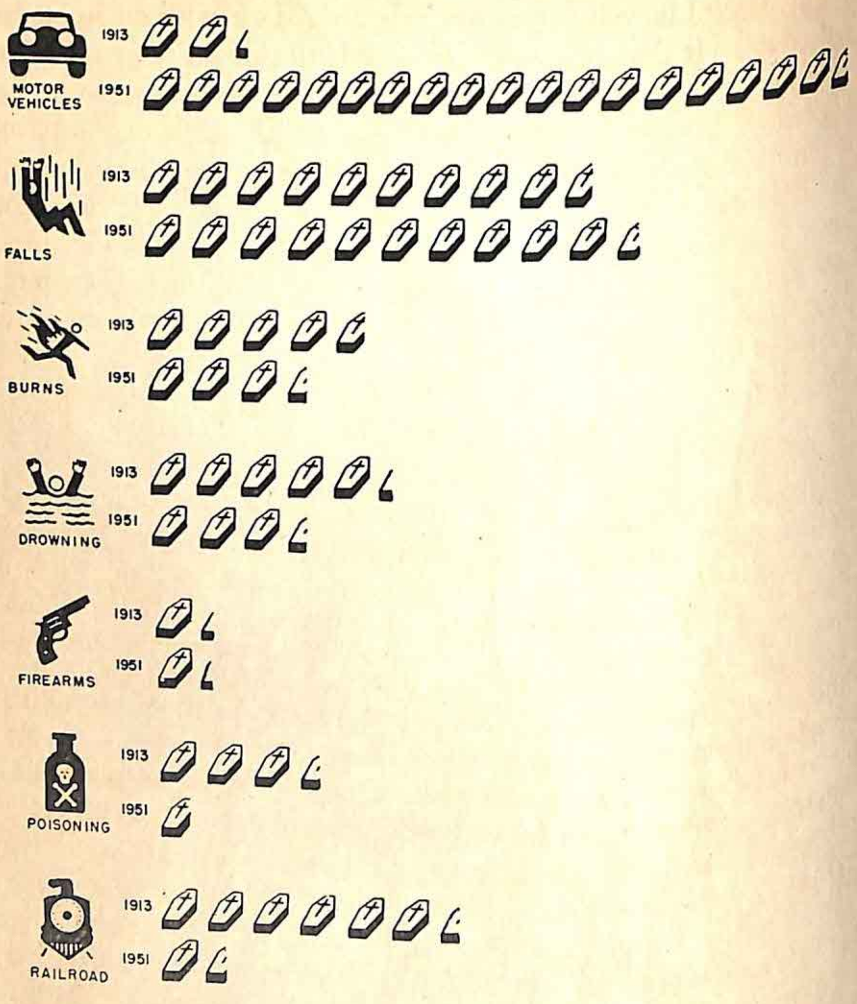
Courtesy National Safety Council

PEDESTRIANS have responsibility for co-operating with drivers and protecting themselves. They should obey traffic signals and walk within safety lanes.

The careful pedestrian, looking to the left and then to the right, crosses streets only at intersections or at marked foot-walks. He obeys traffic policemen and traffic signals. He is alert, paying particular attention to turning vehicles. Wherever possible he leaves an automobile, or other vehicle, from the side which is not next to moving traffic. On country roads and highways he walks on the left side of the road facing the cars as they meet him. At night he carries a light, or wears something light-colored on his arm, so that he can be seen by the motorist. The motorist should slow down and use his horn in time to allow the pedestrian to see the approaching car and to decide which way to step aside.

"Watch your step." Do not try to get on or off a streetcar or other public vehicle while it is in motion. Face toward the front of the car and step forward with the right foot outside while alighting. Look out for automobiles before getting off a streetcar, and wait in the safety zone until the way is clear before going to the curb. Waving one's arms or leaning out of the streetcar or

DEATH RATES DUE TO ACCIDENTS



Each coffin represents 2 deaths per 100,000 population

PICTOGRAPH CORPORATION

auto window is dangerous. All parts of the body should be kept inside of the conveyance.

The bicyclist. The bicyclist acts dangerously when he disobeys highway signs, cuts across traffic unexpectedly, or turns without signaling. Accidents often occur while the motorist is trying to dodge a bicycle.

The careful bicyclist does not ride after dark without lights or reflectors. He does not weave from side to side on the road. He does not ride on the sidewalk or in groups spread out over the highway. Instead, he uses a safe lane near the edge of the pavement. He does not defy the motorist with "smart-aleck," daredevil stunts or try to hold on to a moving vehicle. He does not carry a passenger on the handle bars in traffic. In avoiding these acts, the bicyclist shows good sense, courtesy, and promotes safety. To be a good bicyclist, one must exercise the same precautions as a good automobile driver.

In conclusion

THE way to reduce the accident toll is to eliminate as far as possible all practices which imperil our lives and those of others. The pursuit of safety is a point of view which may be developed until it becomes a state of mind in which one is willing and able to think before, and in, action. Each individual must become safety-conscious.

Consciousness of hazards, and courtesy and consideration for others, constitute the basic factors of every known safety rule; without them no one can be safe. As far as possible each person should practice self-control and should take responsibility for the safety of others at all times as well as in times of emergency or sudden crisis.

Activities

1. Make a report on the work of the National Safety Council, 20 North Wacker Drive, Chicago, Illinois.
2. Discuss jaywalking and signaling cars on the road.
3. Write the State Bureau of Motor Vehicles for pamphlets on automobile safety.

Test

Directions: On a separate sheet of paper write the numbers from 1 to 9, corresponding to the numbers of the statements given below.

Place a letter at the right of each number as follows. Do not write in the book.

A, if you agree with the whole statement.
U, if you are uncertain how you feel about the whole statement
D, if you disagree with the whole statement.
X, if you do not understand the statement.
(Check each statement; omit none)

1. I believe that an automobile should be kept in good running order through periodic inspection.
2. I believe that any person who drinks even a small amount of alcohol is an unsafe driver.
3. I believe that persons who cannot control their own attention can never be good drivers.
4. I believe that the person who crosses the street at any place in the block except at intersections is one of the chief causes of automobile accidents.
5. I think that persons who do not have clear vision and good hearing should not be permitted to drive a car.
6. I think that the muscular adjustments necessary in operating a car should be automatic before a person is allowed to drive a car alone.
7. I think every driver is confronted with certain limitations, physical or mental, for which he must compensate.
8. I am sure that many highway accidents may be traced to the mental state of either the car operator or the pedestrian.
9. I am sure that to be a good bicyclist one must exercise all the precautions that a good driver of an automobile does.

Associated subjects

Biology: The response of the nervous system to stimuli. . . . Reaction time. . . . Conditioning reflexes.

Physics: Ways of improving conditions for safety, including careful manufacture and operation of machines, such as automobiles, safety devices, and appliances used in the home.

Psychology: States of mind which influence reactions toward difficult situations. . . . The need for development of safety habits.

Social science: The automobile in modern life and the various problems it has created. . . . The need of uniform traffic laws, drivers' tests, and insurance protection. . . . Ways in which transportation systems and industries are dealing with safety problems.

References

Accident Facts. National Safety Council.
CLEMENSEN and LAPORTE. *Your Health and Safety.*
RATHBONE, BACON, and KEENE. *Health in Your Daily Living.*
Sportsmanlike Driving. American Automobile Association.
WILSON, BRACKEN, and ALMACK. *Life and Health.*

Films

Bicycling with Complete Safety. 10 minutes, sound. Bell and Howell.
Once Upon a Time (street safety). 10 minutes, sound, color. Metropolitan.

30. *YOU ARE NOT EVEN SAFE IN YOUR OWN HOME*

PEOPLE are concerned about the number of traffic accidents but, serious as this is, the number of persons killed and injured in the home exceeds those in automobile accidents. In 1951, according to the National Safety Council, 28,000 persons were killed and 4,200,000 injured in home accidents. In motor vehicle accidents 37,300 were killed and 1,300,000 persons were injured. Injuries in the home occur most frequently to persons over sixty-five years of age and to children under five years of age. The accidents are chiefly falls, burns and scalds, suffocation, and poisoning. Many of these accidents in the home could be prevented. Stairways, the outside yard, and the kitchen are the most hazardous areas in the home.

Do you know . . .

1. *In what ways the home can be made a safer place?*
2. *What is the chief cause of accidents in the home?*
3. *What conditions in the modern home cause suffocation?*
4. *In what ways poisoning may occur?*
5. *What precautions are necessary to prevent fires?*
6. *How accidents on the stairs in your home can be prevented?*
7. *What precautions should be taken if poisonous substances must be kept in the home?*
8. *What can be done to prevent poisoning from carbon monoxide gas?*
9. *Why poisons sometimes develop in home-canned foods, such as beans and peas?*
10. *Why the cleaning of garments with gasoline or benzine is dangerous?*
11. *Who is largely responsible for accidents due to the use of matches?*
12. *How a round ivy bowl may become a fire hazard?*
13. *What to do if one's clothing catches on fire?*
14. *How injuries from fireworks may cause serious infections?*
15. *What special precaution should be followed when swimming, skating, skiing, or mountain climbing?*

Courtesy National Safety Council

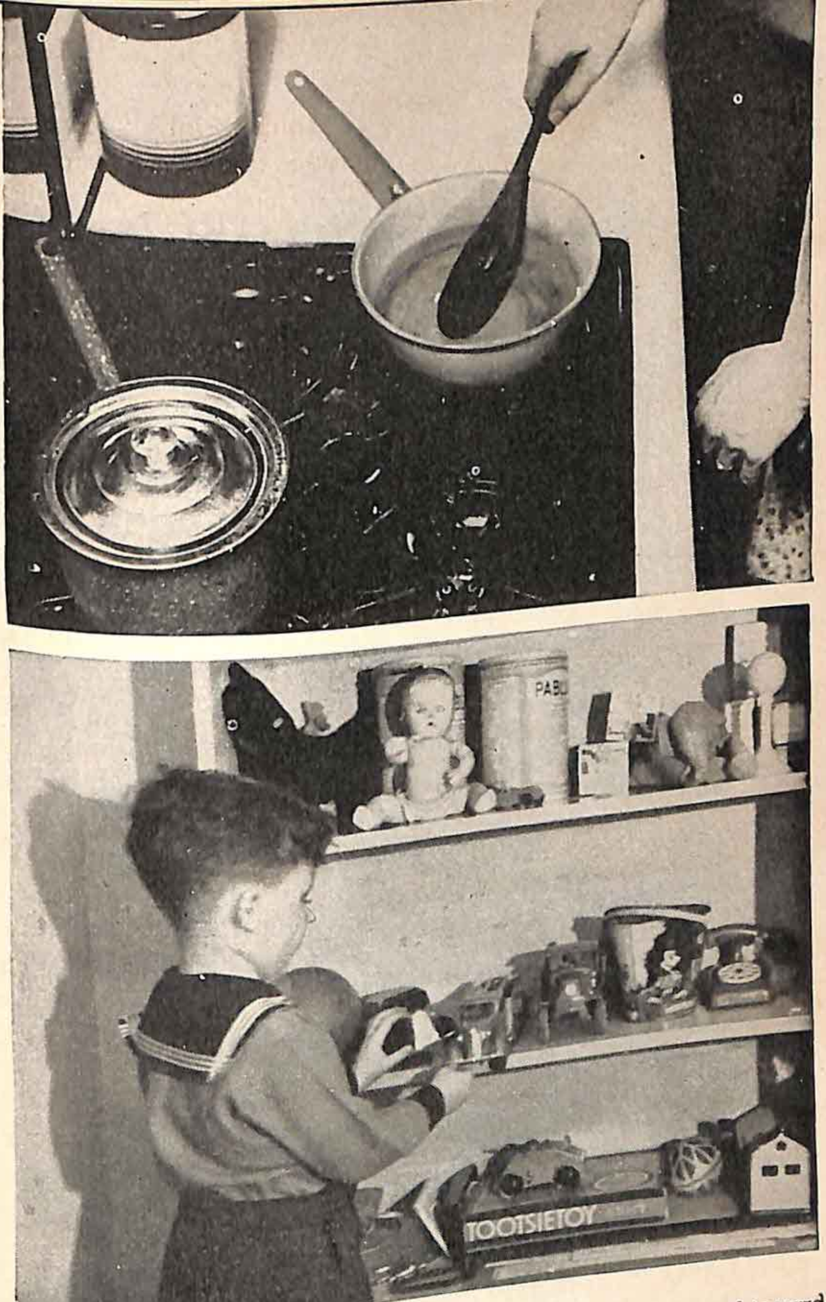
REMOVING ice from sidewalks, keeping stairways clear, carefully labeling all bottles in the medicine chest, and washing sharp knives with care are some of the commonplace precautions for every homemaker.

Courtesy National Safety Council

THE USE of a strong stepladder, such as shown in this picture, rather than a chair or a box, makes reaching up to high places less dangerous.

Avoiding falls. More injuries in the home result from falls than from any other type of accident, and the majority of those that are fatal occur in the bedroom. Almost three-fourths of the accidental deaths among persons over sixty-five years of age are due to falls. To make the home freer from such accidents, floors should not be too highly polished; floor coverings should be free from holes or turned-up corners; stairs should be kept clear and well lighted; and stair carpets should be securely fastened. Small throw rugs, especially at the bottom or at the top of the stairs, should be considered sources of danger. Rubber mats should be used in bathtubs and in showers, and hand holds, to be grasped when getting in and out of the tub, should be placed on the wall. Toys, brooms, and other small articles should be kept off the floor where persons walk. Doors should not be left ajar for someone to walk into in the darkness. Footstools should be placed so that no one will stumble over them. In the bedroom, the way from the bed to the door should be kept clear. Ice, snow, grease, or any other slippery substance should be removed promptly from floors, steps, and sidewalks. A strong stepladder for reaching high places should be provided in every home.

Preventing burns and scalds. Burns and scalds come second in the list of causes of death in and about the home. These occur



Courtesy National Safety Council

WHERE THERE are children, the handles of pans should be turned toward the back of the stove, out of reach; and a place should be provided for toys to encourage neatness and safety.

most frequently in the kitchen. To prevent such accidents, gasoline and kerosene should not be used in starting fires. Pots and pans of hot liquids should be placed at the back of the stove and turned so that they will not be accidentally knocked over and so that children, if present, cannot reach the handles. Holders should be used to remove hot pans from the stove, and care should be taken in carrying pails of hot liquids.

Special precautions should be taken on wash days. A screen should be placed in front of a grate fire. If gasoline or benzine must be used for cleaning, this work should always be done out-of-doors, and the clothes should not be brought into the house until all the cleaning fluid has evaporated. The handling of dry ice, which may cause severe frostbite, should be avoided. Matches should be kept in metal boxes, out of the reach of children, and children should not be permitted to play near stoves, fireplaces, or bonfires.

Preventing carbon monoxide poisoning. Another cause of home accidents is asphyxiation (suffocation). The majority of such accidents are caused by carbon monoxide gas. Carbon monoxide is one of the constituents of manufactured illuminating gas and is also produced by incomplete combustion when fuel is burned without sufficient oxygen. It forms in furnaces or heating stoves in which an excess of coal burns with the draft closed; it is likely to escape into the room if the damper is shut. This gas injures the person who breathes it, not by displacing oxygen in the lungs, but by interfering with the oxygen-carrying power of the red corpuscles of the blood with which the gas comes into contact in the air cells of the lungs (see p. 210).

Furnace pipes and stovepipes should be kept clean and tight to prevent leaks. The burners of gas stoves should be frequently adjusted so as to prevent the production of carbon monoxide gas. Flues should be provided for gas appliances, and all leaks in gas pipes and gas fixtures should be promptly repaired by an authorized gas fitter. Before going to bed, or before leaving a room for a long interval, the gas from stoves and other fixtures should be turned off. Children should not touch or play with gas fixtures. Before starting the engine of a car in a garage, the garage doors should be wide open, and the garage should be kept open as long as the engine is running.

Guarding against poisons. Third in order of frequency in the home are accidental deaths due to poisons other than gas. About one-third of the deaths from this cause are among children under five years of age.[1] All medicines should be labeled and kept in locked cabinets or on high shelves where children cannot get them. Medicines not in use should be thrown away. One should never take medicine in the dark, and one should be sure to have the correct medicine before taking it. Every bottle containing a poisonous substance should have a special mark of identification. Illegible and destroyed labels should be renewed. Common household chemicals, such as ammonia, lye, and lysol, are dangerous and should be kept out of the reach of children.

It is not safe to eat any food that has an abnormal odor or appearance. Every now and then persons die from eating certain home-canned foods—such as beans, peas, asparagus, spinach, and meat—which have become poisonous. This form of poisoning is called *botulism*. The poison is formed by a special germ which grows in the food in the absence of air. A safe practice is to boil all canned vegetables, meats and soups (especially home-canned), from five to thirty minutes before serving. Boiling destroys the poison, and the more solid foods should be boiled the longest.

Preventing fires. The total property loss from fire in the United States for the year 1951 was $731,000,000.[2] Fires in the home can be prevented by continuous care and watchfulness on the part of every member of the family. Matches, defective chimneys and flues, incendiarism, overheated stoves, furnaces and boilers, sparks on the roof, and the misuse of electricity are among the chief causes of such fires. Smokers are responsible for more than one-half of the damage caused by matches. Fires in the living-room generally originate near ash trays and the fireplace. Ashes and oily rags should be placed in metal containers. Fires should never be started by using kerosene or gasoline.

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[1] *Accident Facts* (Chicago: National Safety Council, 1952).

[2] *Accident Facts* (Chicago: National Safety Council, 1952).

A round goldfish or ivy bowl can be a real hazard. If placed where the rays of the sun coming through a window will be focused to a point by the curved surfaces, and if the focused rays fall upon combustible substances, sufficient heat may be produced to start a fire.

If one's own clothing catches fire, one should roll up in a blanket or woolen rug (leaving the head uncovered), and thus smother the flames. If such materials are not available, one should lie down, roll over slowly, and use the hands to help beat out the flames. Running for help makes the flames burn faster.

Defective wiring is another cause of fires, so periodic inspection of electrical wires and connections is necessary. Wiring done by amateurs often causes fires. Electric appliances should be well insulated and should be disconnected when not in use. The electric iron should have an asbestos pad or metal platform.

Safety in outdoor sports. In addition to traffic mishaps, accidents occur outside the home, in public buildings, public conveyances, and in outdoor sports. Swimming is a healthful outdoor sport, but certain precautions should be observed. Swimmers should go in pairs and keep a check on each other, particularly at public bathing beaches. A bather should never go into water over his shoulders unless he can swim. Inexpert diving is often the cause of drowning, and fatal accidents frequently result from diving in shallow water. One should not go bathing or swimming alone and should wait at least one hour after eating before going into water. Those who swim much should have periodic physical examinations and should know how to give artificial respiration.

Before you start to skate, be sure the ice has been inspected carefully. Ice less than four inches thick, and ice on reservoirs, canals, and rivers which has been left unsupported because of the receding water level, may be dangerous.

A skier should not try unknown slopes unless he has looked them over. He should protect his eyes with dark glasses to prevent snow-blindness. Coasting in cities should be limited to streets that are roped off for such use.

Mountain climbing, even in summer, should never be attempted alone. When hiking, care should be taken to avoid poison ivy and to protect oneself against the bites of poisonous snakes and insects.

Firearms. Man is safer without a gun. No one but a policeman or soldier is justified in making a regular practice of carrying firearms. When brought into the home, firearms constitute a deadly hazard, and they place an especially grave responsibility upon parents. All firearms should be kept under lock and key, away from children.

Many accidents occur while men and boys are hunting. In opening the gun to see if a shell is present, or in picking it up or taking it down from a rack, a loaded gun may go off accidentally. Hunting or target rifles and pistols should be put away unloaded.

The growing sentiment against the use of fireworks on the Fourth of July is well founded, for many serious accidents from this practice occur every year. Not only are many persons killed or injured by explosions, but injured persons frequently develop a very serious germ infection known as *tetanus* or lockjaw.

In conclusion

APPROXIMATELY one-third of all fatal accidents and one-half of all injuries occur in and about homes. Those accidents are the result of unsafe conditions and careless practices.

The home will become a safer place to live in when there is careful planning in building and furnishing it. There must be periodic inspections to see that everything is in good repair. Each and every member of the family must co-operate in eliminating risk of accidents.

Activities

1. List forms of negligence which may result in fire.
2. State reasons why so many accidents occur on stairways, in the yard, and in the kitchen.
3. Make an inspection tour of the home to look for broken window catches, protruding nails, loose hinges and hand rails, and unprotected radiators.

Test

Directions: There are five incomplete statements in this test (A, B, C, D, and E), each followed by a varying number of parts. One or more of these parts, or perhaps none of them, correctly completes the incomplete statement. On your paper copy the five letters and the numbers of the parts in a vertical column. Place a plus sign (+) after the number of each part that correctly completes the statement. Do not write in the book.

A. The chief cause of accidents in the home is
  1. poisoning.
  2. burns and scalds.
  3. falls.
  4. suffocation.

B. Children can be protected from accidents in the home by
  1. placing pots and pans at the back of the stove.
  2. keeping medicines in a locked cabinet.
  3. placing toys when not in use on the back stairway.
  4. putting matches on the table.

C. Carbon monoxide is injurious because it
  1. takes the place of oxygen in the lungs.
  2. destroys the oxygen-carrying power of the red corpuscles.
  3. is odorless and so cannot be detected.
  4. is formed when gas burners are poorly adjusted.

D. Home-canned foods are dangerous if they
  1. have an unusual odor or appearance.
  2. contain the germ of botulism.
  3. are cooked twenty minutes before they are served.
  4. have been kept in an airtight container.

E. Each home, in order to reduce the number of accidents, should have
  1. polished floors.
  2. a strong step ladder.
  3. well-lighted stairways.
  4. small rugs.
  5. rubber mats for the bathtub and shower room.

Associated subjects

Biology: The nature and method of prevention of poisons in foods. . . . Cause of tetanus.

Chemistry: Gases and other substances that are poisonous. . . . The solvent action of gasoline and benzine. . . . The nature of explosive gases.

Home economics: The selection, arrangement, and care of furniture and equipment in the home to prevent accidents. . . . Home canning of foods.

Physics: Principles governing the construction of chimneys and fireplaces. . . . Care and use of electrical equipment. . . . Refraction of light, the cause of fire.

Social science: Responsibility and cooperation of the individual in the prevention of accidents in the home. . . . The services of the municipal fire department. . . . Ordinances relating to building.

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Film

Safety in the Home. 12 minutes, sound. Encyclopaedia Britannica.

31. SCHOOL AND WORK ALSO PRESENT DANGERS

IN CHOOSING a job, a person should consider the hazards involved. In some cases the dangers can be largely avoided; in other cases they are a part of the job itself. One should know the difference between risks that are foolish and those that are unavoidable. Carelessness on the job may result in impairment of future usefulness or even in loss of life.

About two-thirds of American wage earners are employed in the industries. This means that a goodly proportion of high school students will enter some kind of industrial work and so will be concerned with industrial safety. Such skill in the handling of tools as you now acquire will go a long way toward fitting you for a mechanical occupation after you leave school.

Do you know . . .

1. Where the greatest number of accidents occur within the school building?
2. How accidents within the school building can be prevented?
3. Why school shops and laboratories present special hazards?
4. How periodic inspections of the school building may help to reduce accidents?
5. What the three chief causes are of industrial accidents?
6. In what ways industrial accidents can be reduced?
7. How industrial production is affected in wartime?
8. What bad practices interfering with safety exist in your school and how they can be corrected?
9. Why fires in a school are even more dangerous than in the home?
10. Why fire drills should be a part of school routine?
11. How the wearing of loose clothing in shops may cause accidents?
12. Why tools and equipment should be put away when not in use?
13. Why a medical examination of the worker is important?
14. What physical factors lower the efficiency of the worker?
15. What personal habits will protect the worker against accidents
16. Upon what, safe procedures of work depend?

Courtesy National Safety Council

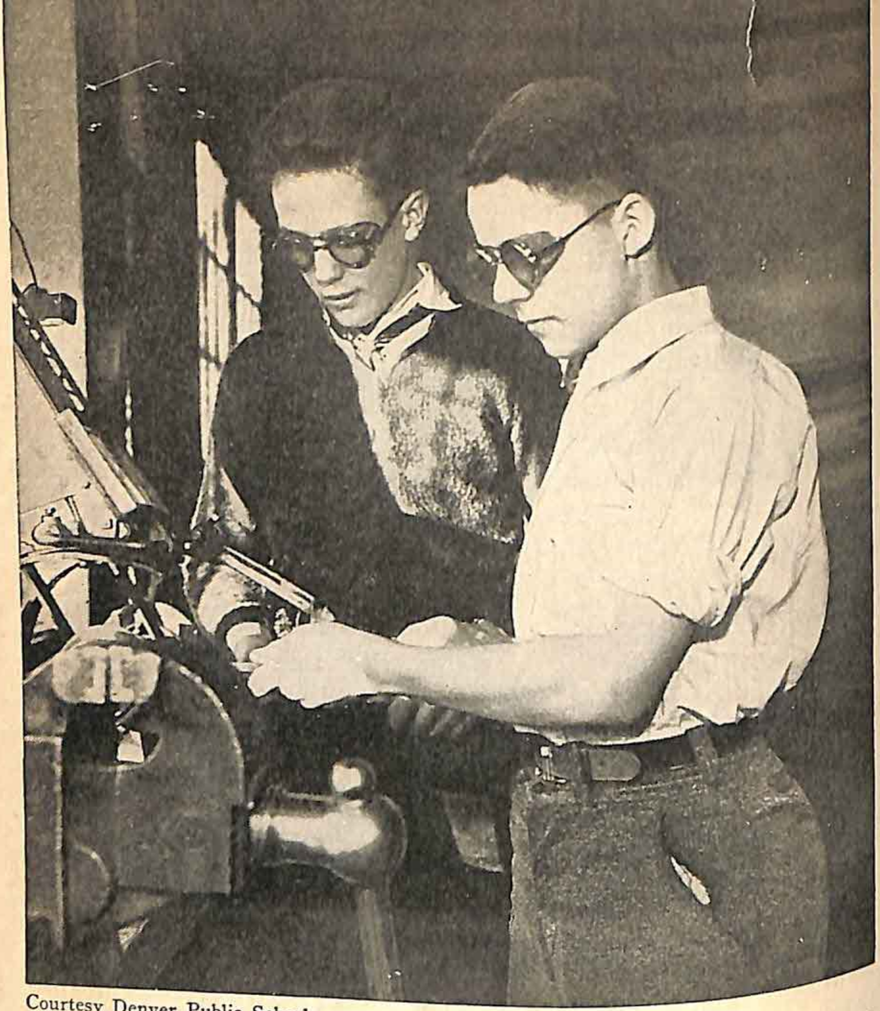
WELL CONDUCTED fire drills, repeated at regular intervals, are necessary precautions for safety of pupils in large schools.

Safety in the school. According to statistics, the school is a safer place to be in than the home. Yet many serious accidents occur to school children. Accidents of children 5 to 14 years old differ from those of the 15 to 19 year group. The death rates are lower, and the trend through the years has been more favorable. Accidents are the chief cause of death between the ages of 15 and 19. Tuberculosis ranks second, but there are less than a third as many deaths from it as from accidents. Thus you can see why a study of accident prevention is so important.

About one-half of all accidents among school children occur within the school building, on the school grounds, and on the way to and from school. One-third of the accidents within the school happen in the gymnasium, and one-fifth occur in the halls and on the stairways. The majority of these accidents may be traced to inadequate equipment or to carelessness on the part of the students.

Many of the hazards found in the home also exist in the school. Some bad practices within the school are the sudden opening and closing of doors, running and shoving in hallways, crowding on the stairways, and throwing of missiles. Courtesy and consideration for others would do much toward prevention of accidents within the school.

Fires. The danger from fires within the school must not be underestimated. A fire in a school is more serious than in the



Courtesy Denver Public Schools

THESE BOYS protect their eyes against injury from flying particles. Modern industry stresses safety in all fields.

home, since many more people are involved. Every school building should be constructed so that no fire hazard can exist.

As a special precaution, fire drills should be conducted at regular intervals. In a well-conducted fire drill for a large school, all pupils should be out of the building in a few minutes and without any confusion. Talking should be avoided, because it is likely to increase the risk of excitement or panic if there is a fire.

The school shop. Every accident in industry indicates either defective machinery or carelessness on the part of the worker.

In the school shop conditions exist similar to many found in industrial work. Here are found such problems as guarding the dangerous parts of machinery and the care and use of tools.

Goggles should be worn whenever a task involves any danger to the eyes. The wearing of a cap may prevent the hair from being caught in the machinery. Loose clothing should not be worn.

Medical examinations are important in order to detect any physical defects that might interfere with the safe operation of machines. Anyone with such a defect should be excluded from shop classes.

Efficiency in work requires attention and close observation, physical alertness, and quick thinking; it demands proper coordination of brain and muscle, and self-control in times of emergency.

Good housekeeping. Neatness and orderliness contribute to a reduction in the number of accidents. This is true not only in the classroom, but also in the laboratories and vocational shops. Definite places should be provided for tools when not in use. Waste paper, bits of lumber, and oily rags should be placed in suitable metallic or noninflammable containers. Work materials should be stored so that they are readily accessible. Adequate, well-lighted aisles should be maintained in all shops and storage rooms. Inadequate lighting in school shops has been responsible for many accidents. Proper ventilation is important. Provision of some kind should also be made for carrying off fumes, gases, and dust.

Industrial accidents. Since 1926 the number of disabling injuries per million man-hours has declined 67 percent, but most of this decrease occurred prior to 1933. In 1935 accidental deaths not due to vehicles had decreased 19 percent, while fatalities from motor vehicles had increased ninefold. In 1951 the number of days lost per thousand man-hours because of accidents was an expensive item in production.[1] Occupational fatalities increased in 1951 for the second consecutive year. The 16,000 total was 500 more than in 1950 and 1,000 more than in 1949. Occupational

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[1] *Accident Facts* (Chicago: National Safety Council, 1952).

Courtesy U. S. Public Health Service

A RESEARCH PATHOLOGIST is examining tissue from animals that have been exposed to materials, such as dust and poisonous gases, which produce industrial hazards.

injuries also increased. The accident rates in larger plants averaged considerably below the rates in smaller plants. Within recent years many improvements in machinery and in the conditions surrounding the worker have been made. As a result, the number of accidents has been decreasing and efficiency in production has been increasing.

Causes of accidents. Accidents in the industries happen chiefly because of inexperienced workers, unsafe procedures, and defective or poorly designed machinery. Other causes, given in order of importance, are improperly guarded machines, loose wearing apparel, physical defects among workers, and inadequate ventilation and lighting of the plants.

In order that the number of accidents may be reduced, the skilled worker must operate sound machinery, adequately guarded. He must be physically fit and work in a place that is well ventilated and lighted. The worker must develop a safety consciousness and be trained in safe practices. He should protect himself by wearing the right kind of clothing.

Many occupations in industry involve dangers that are inherent in the particular activity. The workman must be able to face these dangers if he is to continue in his occupation. Unnecessary hazards, however, should be eliminated. Mental and physical strains caused by domestic troubles, financial worries, excessive smoking, use of alcohol, fatigue, and lack of sleep increase the hazards of the worker.

Provisions for health of employees. Illness is expensive for the worker and for his employer as well. It is estimated that 4,300,000

Courtesy U. S. Dept. of Labor

MACHINES in this factory have guards, and the work-places are well lighted to protect the workmen against injury.

man-hours of work are lost annually because of injuries. There is great additional loss due to absences from work because of colds and minor illnesses. These absences and lowered ability to work when on the job reduce production.

Many industries have health service departments so that employees will be protected and encouraged to seek professional care. First aid in emergencies is one service performed by the industrial nurse. Regular health examinations are given and treatment administered in the clinic by company doctors. More extended medical care in homes and hospitals is provided by some companies. The cost of such service frequently is shared by employer and employees through contributions based on a percentage of the wages.

Good lighting, control of noise, and regulation of temperature promote health and efficiency of workers. Management is finding that regular rest periods to break monotony and reduce fatigue lower accident rates.

Courtesy U. S. Dept. of Labor

WELDING becomes a less dangerous occupation if the workman is protected by a helmet with a window of nonshatterable glass and if he wears heavy gloves and clothing.

In conclusion

THE ability to think and the reaction time of the nervous system of human beings have certain limitations. Therefore, as the complexity of machinery increases, more effective automatic controls must be established in order to reduce the number of accidents. Operators of machinery must be trained in the specific things to do or not to do in order to avoid accidents. Machinery may be improved indefinitely, but the determining factors for safety will always be the care taken by the operator and his behavior in the time of emergencies.

Activities

1. Develop a plan for a school safety campaign in which officers of the student council, principal, and teachers would co-operate. Prepare a report with suggestions for improvement of the most serious hazards in the building and on the grounds.

2. Make a list of practices that would help to reduce accidents within the school, and then try to follow them.

3. Make a study of the efficiency of machinery guards in the school shop; also locate any unguarded hazards.

4. Visit an old and a new industrial plant and compare ways in which older machinery was guarded and the improved devices by which the new type of machinery is protected.

5. Visit an industrial plant to observe work that is monotonous in character.

6. Visit the health service department of an industrial or business organization to learn the provisions for the protection of the health of employees.

7. Write to the State Department of Labor for pamphlets that give the state regulations for protection of workers in industry.

8. Compare the standards established by state departments of labor and industry, industrial and insurance companies, and safety organizations.

Test

Directions: Each of the following statements is either true or false. On a separate sheet of paper write the numbers from 1 to 15, corresponding to the numbers of the statements. Write **T** to the right of the number if the statement is true and **F** if the statement is false. Do not write in the book.

1. Every person, before learning to operate a machine, should have a medical examination to detect any serious physical impairments.
2. The school is safer than the home.
3. The gymnasium is the safest place in the school.
4. All high school boys and girls will enter some kind of industrial work.
5. The efficient use of tools depends upon muscular co-ordination.
6. Poor lighting is frequently the cause of accidents in storerooms.
7. As machines become more complex, the number of accidents decreases.
8. Accidents are the chief cause of deaths between the ages of 15 and 19.
9. Inexperience, unsafe procedures, and defective machinery are the chief hazards in industry.

10. Ordinary ventilation removes all fumes, gases, and dust from the workshop.
11. The reaction time of the worker will always be a factor in the cause of accidents.
12. Becoming safety conscious helps to protect the worker from accidents.
13. Fatigue and lack of sleep reduce the efficiency of the worker.
14. The school fire drill is conducted for the purpose of giving pupils a short period of relaxation.
15. The student council, the principal, and the teachers are the only persons who need to concern themselves about safety within the school building.

Associated subjects

Biology: Principles governing a sound nervous system. . . . Reaction time. . . . Muscular co-ordination. . . . Effect of dust and gases on the organs of respiration.

Chemistry: The formation and effects of poisonous gases. . . . Spontaneous combustion. . . . Industrial hazards due to gases.

Home economics: Selection of food for the industrial worker.

Physical education: Building physical fitness through well-planned exercises.

Physics: Careful manufacture and operation of machines. . . . The mechanical principles incorporated in machines. . . . Safety devices. . . . Systems of ventilation, heating, and lighting. . . . Air-conditioning.

Psychology: States of mind which influence reactions toward emergencies. . . . Development of habits of safety.

Social science: Ways in which industries are dealing with safety problems. . . . Laws protecting the worker. . . . Safety organizations.

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32. ALL COMMUNITIES MUST LEARN PROTECTION

IN EVERY community there is a possibility that conditions dangerous to health may be overlooked or neglected until severe damage has occurred. Serious malnutrition may result from lack of essential articles of diet. Or a communicable disease may rapidly assume epidemic proportion because of previous indifference to immunization or quarantine.

In a severe flood or after a hurricane the living habits of the community are upset. People made homeless by such disasters are confronted by extraordinary hazards. In addition to the risk of the spread of communicable diseases, the morale of the individual is often undermined by fear, anxiety, and grief over the loss of cherished possessions.

Congested production centers still present many health problems. Inadequate housing, inability to get supplies for needed repairs and upkeep of sanitary facilities, lack of adequate recreational opportunities, and shortages of hospital and medical services all threaten health. Continuous effort must be put forth for the maintenance of health standards and for health education and medical care for more people.

Do you know . . .

1. *Why communicable diseases may become a serious menace when living conditions are disturbed?*
2. *Why nutrition is an important national problem?*
3. *Why rationing is sometimes necessary?*
4. *How a well-planned daily routine can help in building morale?*
5. *In what ways young people can help to lessen the responsibilities of those employed in essential industries?*
6. *Why organization of citizens is especially necessary in times of great emergency?*
7. *How the maintenance of health may be difficult in overcrowded areas?*
8. *Some of the protection services and opportunities which are available in your community?*

Lurking dangers. Many persons in the United States suffer from chemical starvation. Through malnutrition the body lacks minerals and vitamins which are essential to the normal functioning of the body. This causes a gradual and often unsuspected undermining of health.

A national program for better nutrition should flourish at all times. Choosing and eating food that will build healthy bodies is a problem for every individual. The housewife who has the financial means can, through careful study, provide a family diet that is nutritionally sound (see p. 180). But she can also assist in nutrition programs for the less fortunate. She can take an active part in group-feeding projects, such as community kitchens and school lunchrooms. She can help in the promotion or creation of community gardens, and in scientific preservation of food.

Sick persons are occasionally harmed by well-meant but unscientific treatment. Medicines which are helpful for one person may have the opposite effect for another who has the same symptoms. Indiscriminate use of advertised drugs is undesirable or even dangerous. Whenever sickness developes, expert advice should be obtained and followed.

Many communities do not have sufficient doctors, nurses, or hospital accommodations to care adequately for their citizens. Home nursing and first aid information should supplement efforts to maintain healthful conditions in such communities.

Overwork, anxiety, and strain are chief factors in the increase in physical and mental breakdowns. Adequate compensation for work done, healthful living and working conditions, and opportunities for rest and play help create wholesome mental attitudes. Forgetting one's self in service for others brings its own rich reward.

Recurring diseases. Epidemics may occur in any community, even with the highest standards of healthful living and although such a community has planned a pure water supply, proper disposal of sewage, efficient food inspection, and enforcement of quarantine regulations.

As large numbers of people move around the country, health hazards may be created. Itinerant workers following harvests across the country, rural populations drifting toward urban areas, and the multiple vacationists traveling by auto or train to every part of the nation may carry disease germs from one community to another.

Inadequate housing facilities for these shifting populations have prevented the maintenance of necessary sanitary precautions. Furthermore, overcrowding, undernourishment, and fatigue lower body resistance. Dormant cases of tuberculosis may become active and infect other people. A polluted water supply may give rise to a serious epidemic of gastro-intestinal illnesses, among which is typhoid fever.

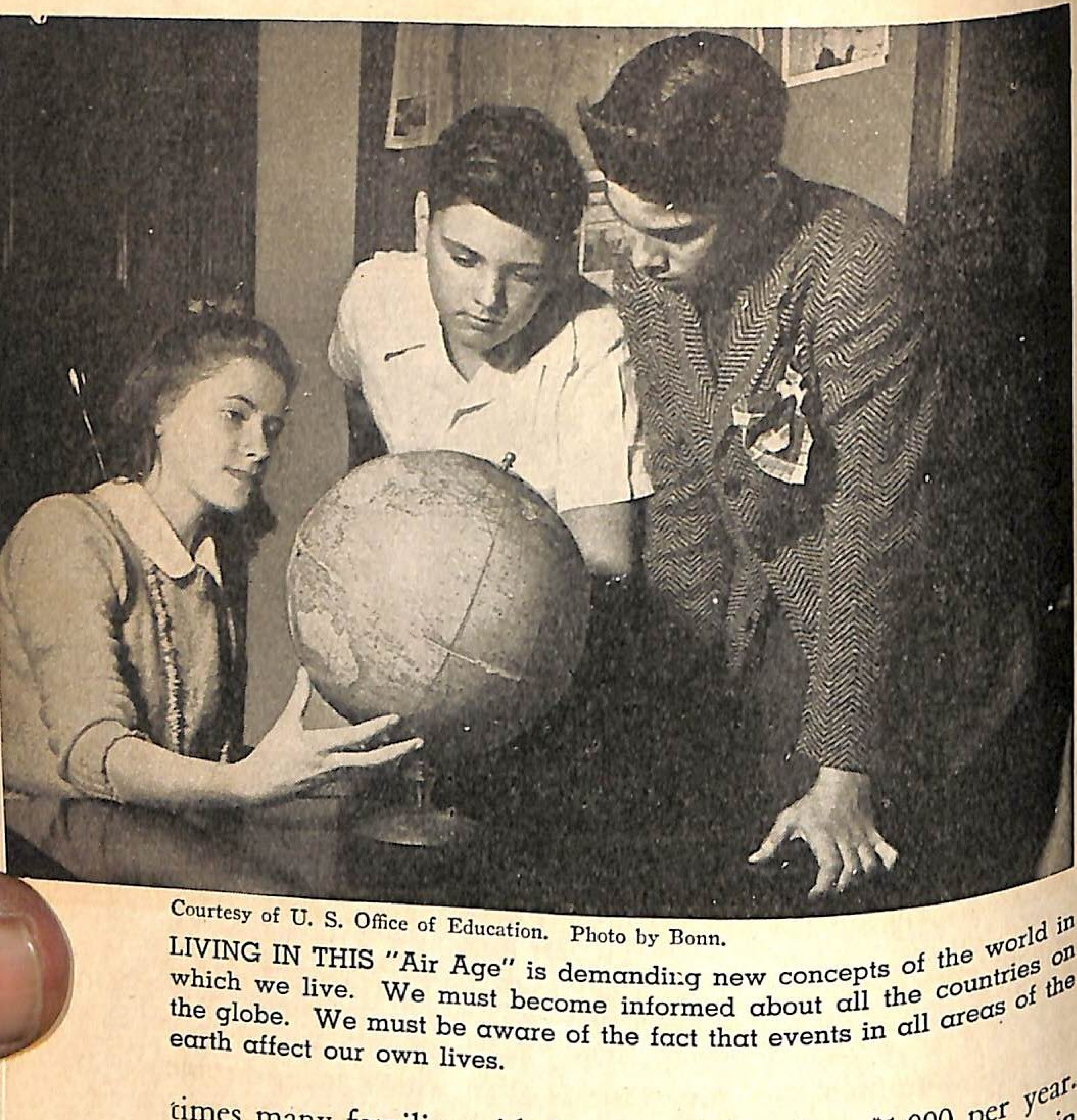
Smallpox occurs chiefly in scattered epidemics. Vaccination is an efficient protection against this disease. But in a number of localities immunization against smallpox is not compulsory, and in such areas a single diseased person arriving from another community may be the cause of a severe epidemic.

In World War I influenza became pandemic, that is, it was prevalent in many countries of the world. Prevention of the occurrence of such serious epidemics will require the co-operation of all people in obeying established regulations.

Social conditions may be a menace to the health of the community. The incidence of syphilis and gonorrhea is declining every year, but recent reports show that there are at least one-half a million new cases of syphilis occurring in the United States every year and over a million new cases of gonorrhea. Over half of these cases are among people between 20 and 30 years of age. More graphically stated, one person contracts a venereal disease every twenty seconds in the United States. Education of the general public will be necessary to combat these diseases.

Safeguarding health. The health of our present and future generations is of chief concern. There must be further research in such fields as nutrition, the detection and cure of disease, and the rehabilitation of all those who have physical defects which may be corrected. Mental illness must receive as intelligent treatment and care as is given physical illness.

Medical care must be made available to all by better distribution of medical services. In the United States there are at normal



Courtesy of U. S. Office of Education. Photo by Bonn.

LIVING IN THIS "Air Age" is demanding new concepts of the world in which we live. We must become informed about all the countries on the globe. We must be aware of the fact that events in all areas of the earth affect our own lives.

times many families with incomes of less than $1,000 per year. These families cannot always pay for adequate medical service in severe illness. Communities must provide this care. Families with moderate incomes frequently cannot pay the entire cost of expensive medical service. Hospitalization and health insurance groups help share this cost. Although medical education in the United States ranks high, the availability of medical care is not uniform among different groups of the population.

Our responsibilities. There is sometimes a tendency among young people to feel that they have no responsibility in an adult-

Courtesy Denver Public Schools

THESE GIRLS are helping in a preschool and at the same time learning how to work with young children.

directed community. Many of the ways in which young people can help do not differ greatly from the ways in which older people can help. Young people are already junior citizens with many of the responsibilities of citizenship. Protecting their own health and that of others and aiding those agencies which are working for improvement in health conditions can be major contributions of all youth.

The daily routine. Being fit for any emergency should be the ambition of every boy and girl. A daily routine, well planned and followed, will help greatly to keep up efficiency.

Everyone ought to contribute to national efficiency by intelligent

Courtesy Denver Public Schools

ONE WAY of being useful is to assist in the school library.

conservation of materials and energy and proper utilization of time. Each person would do well to plan a program for each day's work and recreation. The day's schedule should include a definite time for getting up in the morning, a time to leave for school, a time for play, and also a time each day for the development of some constructive skill.

Being useful. From the hours usually devoted to recreation, some time should be set aside regularly for socially useful service. In the field of health there are many such opportunities. Summer camps and playgrounds can use capable boys and girls as assistants. Beside achieving satisfaction from the service that he can render, the assistant finds many benefits from the outdoor life. Part-time and summer jobs are desirable, too.

Because of shortages of trained staff in hospitals, girls and sometimes boys have been recruited for work as nurses' helpers. The experience gained from such service has been excellent preliminary training for those who plan a career in nursing, medicine, or scientific research or work in any phase of health service.

In urban areas where many mothers are employed outside the home, child-care centers have been set up to care for children during the mothers' working hours. In addition the preschool has become a recognized part of many school systems. Girls working in either child-care centers or preschools can learn much about the needs and interests of children. This is excellent preparation for parenthood.

Raising of food crops, caring for animals, preparing and conserving food are useful and interesting social services. Since people all over the world need food, no one can afford to waste any. In the light of this great need, the American people would do well to study very carefully their own food habits. Food is frequently carelessly handled in markets. It is often improperly prepared in homes. Food waste seen in school lunchrooms and on plates in public eating places is a disgrace. Many people could be fed well on what America wastes.

Pest control. Recent research has developed insecticides which are more effective in pest control than any previously available. One of these newer insecticides, DDT, is being widely used as an exterminator. Since many diseases are spread by insects and rodents, their control and extermination is a health problem. Poison dusts against insects are sprayed over infected areas and potential breeding places, often by airplane. Refuse dumps are breeding places for rats. Rats are destructive, dirty, and, as carriers of disease, are a menace to health. Individuals should accept the responsibility of keeping their own premises clean and of destroying pests which appear there.

Safety. As young people approach the age when they may obtain licenses to drive cars, another obligation is placed on them. The driver of as powerful a machine as an automobile should understand that his own life and health, as well as the life and health of many others, may depend on his safe driving.

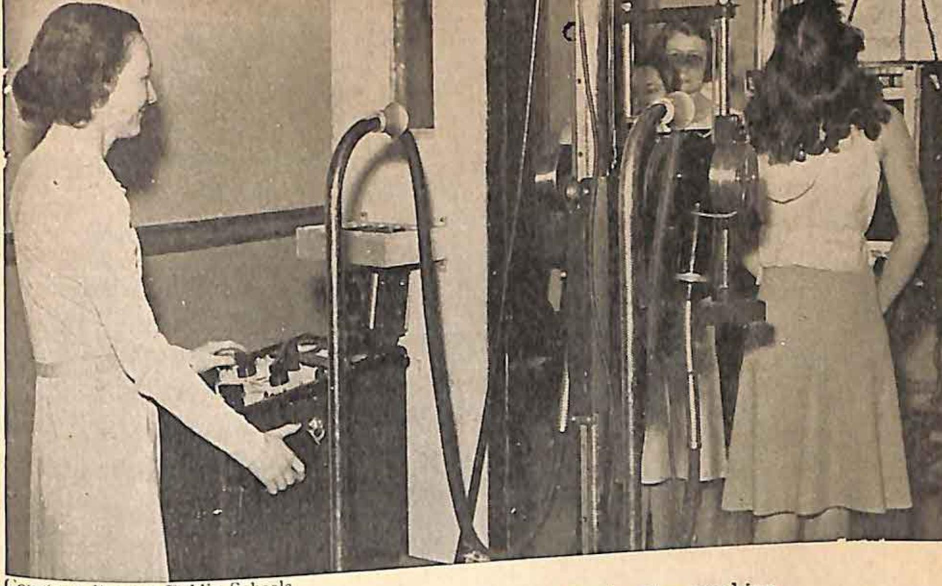
In industry, safety devices for the protection of workers are generally provided. Safety first is constantly emphasized. When workers are off the job, however, they are frequently not careful. Carelessness is indicated by the large number of accidents and deaths in the home, in swimming pools and beaches, and on the public highways.

Community agencies need help. Junior Chambers of Commerce all over the country sponsor annual clean-up and paint-up campaigns. School children usually have an active part in these drives. While beautification may be the chief objective of the campaign, the cleaning up of dirty, unsanitary places is a real health project.

The Junior Red Cross, a branch of the American Red Cross, operates through the public and parochial schools. It is under the joint supervision of the schools and the senior Red Cross society. Young people are trained as hospital, child care, or office helpers in most situations where the Red Cross is serving. A major project is the provision made for the needs of children all over the world wherever the Red Cross is found. Beside providing for the material needs of children and some of their recreation, American youth and children carry on correspondence with children of other nations and, in so doing, they help to establish better understanding and appreciation of their world neighbors.

Several agencies set up for prevention and control of certain diseases have been so effective that nation-wide appeals are made for funds for their continuing operation. The birthday of the late President Roosevelt has become synonymous with the drive for funds for the prevention and treatment of infantile paralysis. Annual birthday balls, and the March of Dimes are two, well-known methods for securing these funds.

The sale of Christmas seals for the support of the National Tuberculosis Association is well known and supported. These funds are used to promote education about tuberculosis, including prevention and casefinding. In addition some of the funds are used for actual care of tubercular patients. Mobile units are equipped with X-ray machines to take pictures of the chest. These units



Courtesy Denver Public Schools

AN X-RAY picture of this girl's chest is being taken by the machine used in the mobile unit of the National Tuberculosis Association. Many cases of tuberculosis are discovered by these examinations.

may be set up in schools, in factories, in rural areas, or wherever groups of people may be photographed. X rays may be taken at the rate of one a minute by this machine. The pictures are small and inexpensive but when read by an expert they are an aid in detecting tuberculosis of the lungs.

Cancer has jumped recently to second place as a cause of death in the total population of the United States. Nation wide appeals are made for funds for prevention and control of cancer. Because delayed treatment makes cure more difficult or even impossible, a large portion of the contributed funds is spent in education so that people may recognize symptoms and seek help early.

Aid for crippled children is sought through various agencies. The annual sale of Easter seals is for this purpose. Benefit games of sport and entertainment contribute generously for this fund which is independent of those funds raised for aid of children crippled by infantile paralysis.

Acceptance of individual responsibility for community welfare does not come naturally. It must be learned. It is a recognized fact that people learn best by doing. Active participation in community enterprises will help develop in young people a sense of responsibility for what takes place in that community. There is a satisfaction which results from volunteer participation in community welfare activities which cannot be paid for in dollars and cents.

Youth canteens. One of the best aids to mental and emotional health of young people which has been developed in recent years is the Youth Canteen. Here an opportunity is provided for boys and girls to gather in wholesome surroundings and to do the things that young folk like to do. Most canteens are directed by boards of their own members who set up their own rules and regulations. An advisory board of adults may be organized for assistance when called upon.

Morale. Good morale, recognized in wartime as an important factor, is also essential in everyday living. Morale is an attitude of mind, a relationship which exists between people. It is based on feelings of zest, hope, confidence, and willingness "to see the thing through" in spite of the sacrifices that may be necessary. Morale gives young people confidence to face problems as they arise and to make the personal effort necessary to solve them. Work helps to build morale. No one can work at his best, however, without periods of rest and relaxation. A balanced cycle of work, play, and rest helps make healthy, happy individuals. The relationships between such persons will create good morale.

In conclusion

ALL people—men, women, and children—should try to organize their daily living routines so that they may have time for work, for rest, and for play. They should work together with a sense of unity to improve their schools, their homes, and the places where they work. They must guard their health and welfare. They must learn to work for and with others. Through cooperation with others for a cause that is common to all a certain feeling of comradeship develops. As emergencies arise they will be met most successfully by those who have initiative and resourcefulness and who are physically fit. These qualities are worth cultivating under any circumstances.

Activities

1. Plan a reasonable program for the day's work and recreation and do not let any minor distractions disturb the plan.

2. Work out a plan of action which in times of emergencies will free you from dependence on nurses, doctors, or specialists.

3. Develop for your school a plan whereby, should a fire or other emergency develop, all students could be evacuated quickly and safely from your building.

Test

Directions: There are six incomplete statements in this test (A, B, C, D, E, and F), each followed by a varying number of parts. One or more of these parts, or perhaps none of them, correctly completes the incomplete statement. On your paper copy the six letters and the numbers of the parts in a vertical column. Place a plus sign (+) after the number of each part that correctly completes the statement. Do not write in the book.

A. Rationing of food becomes necessary sometimes in order
  1. to conserve the limited supplies.
  2. to encourage thrift.
  3. to protect the farmer.
  4. to provide a larger selection.
  5. to assure fair distribution to all persons.

B. In planning meals it is most important
  1. to economize on food.
  2. to make meals appetizing.
  3. to furnish the necessary minerals and vitamins.
  4. to have plenty of food left over for the next day.
  5. to please every member of the family.

C. Smallpox can be controlled more readily than tuberculosis because
  1. it occurs in scattered epidemics.
  2. all persons can be protected by vaccination.
  3. epidemics are caused by a diseased person coming from another community.

D. All volunteers for civilian defense
  1. are adult men or women.
  2. give services without pay.
  3. wear uniforms.
  4. must know how to administer first aid.

E. Good morale is
  1. necessary only in wartime.
  2. based on confidence and willingness to work.
  3. built up by keeping busy.

F. Control of diseases will depend on education of the general public because
  1. people are careless.
  2. new drugs and treatments are appearing constantly.
  3. self-medication is satisfactory.
  4. some people ignore early symptoms.

Associated subjects

Biology: The occurrence of epidemics. . . . Need for special precautions in emergencies. . . . Malnutrition, resulting from lack of minerals and vitamins.

Chemistry: Water purification. . . . New chemicals for insect and pest control.

Home economics: Food selection and conservation. . . . Preparation of new recipes. . . . New food combinations.

Physical education: Physical fitness through physical training. . . . First aid.

Physics: Safety devices. . . . Highway construction. . . . New developments and uses of glass.

Psychology: Control of emotions. . . . Emergency hysteria. . . . Mob psychology.

Social science: Rationing. . . . Responsibility of the individual to the community. . . . Need for recreational centers. . . . International relations. . . . Community agencies.

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United States Public Health Service, Federal Security Agency, Washington 25, D. C.
Upjohn Company, Kalamazoo, Michigan.
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The Glossary

Key to Pronunciation

a

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ā̇ as in vā̇-ca′tion
â as in pâre
ă as in ăct
ă as in in′f*ă*nt
ä as in ärm
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e

ē as in ēve
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ĕ as in ĕnd
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ẽ as in of′fẽr

i

ī as in pīne
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ĭ as in char′*ĭ*-ty

o

ō as in ōld
ō̇ as in ō̇-blige′
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u

ū as in fūse
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oi as in coil
o͞o as in bo͞ot
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ou as in our

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abdomen (ăb-dō′mĕn), the part of the body between the diaphragm and the pelvis.

abdominal (ăb-dŏm′*ĭ*-n*ă*l) **breathing,** the act of inhaling and exhaling air by use of the diaphragm.

abdominal cavity, space below the diaphragm containing the intestines, liver, stomach, pancreas, kidneys, spleen, and reproductive organs.

abscess (ăb′sĕs), a collection of pus enclosed in any part of the body.

absorption (*ă*b-sôrp′sh*ŭ*n), the process by which digested foods pass from the alimentary canal into the blood.

accelerator (ăk-sĕl′ẽr-āʹtẽr), anything that increases the speed of an organ.

accommodation (*ă*-kŏmʹȯ-dā′sh*ŭ*n), automatic adjustment of the lens of the eye for different distances.

acetanilide (ăsʹĕt-ăn′*ĭ*-lĭd), a kind of drug used to relieve pain.

acetone (ăs′ė-tōn), a volatile, fragrant liquid used as a solvent.

acid- (ăs′ĭd) **forming foods,** foods which after combustion in the body yield an excess of acid residue.

acne (ăk′nė), a pimple-like affection of the skin.

adaptation (ădʹăp-tā′sh*ŭ*n), the fitness of an animal or plant to its surroundings.

adenoids (ăd′ė-noids), masses of lymphoid tissue behind the nose.

adolescence (ădʹȯ-lĕs′*ĕ*ns), period of development between childhood and maturity: in boys from 14 to 25; in girls from 12 to 21.

adrenal (ăd-rē′n*ă*l) **gland,** gland located at the top of each kidney; suprarenal gland.

afferent (ăf′ẽr-*ĕ*nt) **nerves,** nerves which conduct impulses inward toward the spinal cord and the brain.

agglutinin (*ă*-gl\u014do\u0304o′tĭ-nĭn), a defensive substance in the blood which masses bacteria so that they may be readily devoured by white corpuscles.

agranulocytosis (ȧ-grănʹu̇-lȯ-sī-tō′sĭs), condition of the blood in which the defensive white corpuscles are greatly reduced in number.

albumin (ăl-bū′mĭn), a class of proteins found in blood serum, milk, muscle, egg, other animal substances, and many vegetables.

alimentary (ălʹ*ĭ*-mĕn′t*ȧ*-rĭ) **canal,** the digestive canal extending from mouth to anus.

alkali (ăl′k*ȧ*-lī), a chemical substance which neutralizes acids and forms salts. In testing, it turns red litmus blue, the opposite of an acid.

alkaloid (ăl′k*ȧ*-loid), an organic substance having alkaline properties.

allergy (ăl′ẽr-jĭ), exaggerated sensitiveness of the body to a foreign protein, such as egg, meat, milk, animal hairs, or pollen.

amidopyrine (ȧ-mēʹdȯ-pī′rēn), a drug used to lessen fever and relieve pain, sometimes poisonous.

amino (*ă*-mē′nō) **acids,** final products in the digestion of proteins.

ammonia (*ă*-mō′nĭ-*ȧ*), pungent gas readily soluble in water, occurring in the decomposition of animal matter.

anaerobic (ăn-ā′ẽr-ō′bĭk) **bacteria,** bacteria that live in the absence of free oxygen and will not grow in the presence of oxygen.

analysis (*ȧ*-năl′ĭ-sĭs), division or separation of a thing into the parts that compose it.

anemia (*ȧ*-nē′mĭ-*ȧ*), insufficiency of red corpuscles or hemoglobin.

anesthetic (ăn′*ĕ*s-thĕt′ĭk), a substance which abolishes feeling or sensation.

aniline (ăn′*ĭ*-lĭn), a coal-tar product, the basis of many dyes.

anterior (ăn-tē′rĭ-ẽr), in front or toward the head. In man the term often means ventral.

anterior horn, ventral projection of the spinal cord from which motor nerves proceed.

anthrax (ăn′thrăks), a contagious bacterial disease of animals, especially cattle and sheep.

antibodies (ăn′tĭ-bŏd′ĭz), defensive substances developed in the blood during an infection. When they remain in the blood after the disease is cured, they confer immunity to the disease.

antidote (ăn′tĭ-dōt), a substance that neutralizes the effects of a poison.

antiseptic (ăn′tĭ-sĕp′tĭk), a substance that prevents growth of bacteria in or on the body. The word is also applied to methods tending to prevent bacterial growth.

antiserum (ăn′tĭ-sē′r*ŭ*m), a serum containing antibodies from the blood of an animal which has been infected by the microorganism or toxin of the disease.

antitoxin (ăn′tĭ-tŏk′sĭn), substance in the blood that neutralizes the toxin or poison produced by bacteria. The antitoxin that is injected in the treatment of diphtheria is blood serum from horses that have been made immune to diphtheria.

aorta (ȧ-ôr′t*ȧ*), the main artery carrying blood from the left ventricle of the heart to all parts of the body excepting the lungs.

apoplexy (ăp′ô-plĕk′sĭ), sudden loss of consciousness, followed by paralysis, caused by brain hemorrhage or blocking of a brain artery by a clot.

appendix (*ă*-pĕn′dĭks), wormlike outgrowth at the junction of the small and large intestine, on the right side of the abdomen; vermiform appendix.

aqueous (ā′kwė-*ŭ*s) **humor,** the colorless, transparent liquid in the front chamber of the eyeball, between the crystalline lens and the cornea.

arsenic (är′sė-nĭk), a chemical element. It and its compounds are extremely poisonous.

arteriosclerosis (är-tē′rĭ-ō̇-sklė-rō′sĭs), thickening and hardening of the walls of the arteries.

artery (är′tẽr-ĭ), blood vessel that carries blood from the heart to various parts of the body.

artificial immunity, immunity resulting from antibodies produced in reaction to living or dead germs or serum from another individual.

aseptic (*ȧ*-sĕp′tik), free from living germs of disease or decay.

asphyxiation (ăs-fĭk′sĭ-ā′sh*ŭ*n), suffocation caused by failure of oxygen to reach the lungs, as in drowning.

aspirin (ăs′p*ĭ*-rĭn), one of the trade names for a compound of acetic and salicylic acids.

assimilation (*ă*-sĭm′*ĭ*-lā′sh*ŭ*n), changing of food into protoplasm—the last act in nutrition.

asthma (ăz′m*ȧ*), disease due to spasmodic contraction of the smaller air tubes of the lungs, causing difficult breathing, sneezing, and a cough.

astigmatism (*ȧ*-stĭg′m*ȧ*-tĭz′m), a defect of vision in which light rays from any single point of an object cannot be focused at a single point on the retina.

athlete's (ăth′lēts) **foot,** ringworm of the foot, often acquired by athletes in gymnasiums.

audiometer (ô′dĭ-ŏm′ė-tẽr), an instrument for measuring the acuteness of hearing.

auditory (ô′d*ĭ*-tō′rĭ) **canal,** air passage in the external ear leading to the eardrum.

auricle (ô′rĭ-k'l), the upper or anterior chamber of the heart that receives blood from the veins.

autonomic (ô′tō̇-nŏm′ĭk) **system,** system of nerve cells and fibers that control involuntary action.

axon (ăk′sŏn), a long nerve fiber with few branches covered by a sheath, carrying messages away from the nerve cell.

bacilli (bȧ-sĭl′ī), plural form of **bacillus.**

bacillus (bȧ-sĭl′*ŭ*s), a rod-shaped bacterium.

backbone. See **spinal column.**

bacteria (băk-tē′rĭ-*ȧ*), extremely small one-celled plants that are ball-shaped, rod-shaped, or spiral in form.

bacterium (băk-tē′rĭ-*ŭ*m), singular form of **bacteria.**

barbituric (bär′bĭ-tū′rĭk) **acid,** an acid whose derivatives are used as a narcotic.

base-forming foods, foods which after combustion in the body yield an excess of alkaline residue.

belching (bĕlch′ĭng), discharging gas from the stomach through the mouth.

bicuspid (bī-kŭs′pĭd), a double-pointed tooth located between canine and molar teeth. Man has eight bicuspids.

bile (bīl), a bitter, yellow or greenish fluid secreted from the blood by the liver.

binocular (bĭn-ŏk′ů-lẽr) **vision,** vision in which both eyes are used to produce a blended single image.

bleach, a chemical or other substance used for whitening or removing color.

blemish, a slight disfiguring mark.

blister, a saclike cavity between the epidermis and the true skin which is filled with fluid.

blood pressure, pumping force of the heart against the elastic resistance of the blood vessels.

blood vessels, tubes in which blood circulates in the body, as an artery or vein.

boil, an inflamed swelling arising from a hair follicle caused by bacterial infection.

botulism (bŏt′ů-lĭz’m), poisoning by a toxin from certain anaerobic bacteria infecting preserved food.

bowels (bou′*ĕ*lz). See **intestine.**

Bright's disease, a kidney disease attended with albumin in the urine; nephritis.

bromide (brō′mīd), a compound of bromine with another element.

bronchi (brŏng′kī), branches of the trachea or windpipe.

bronchitis (brŏn-kī′tĭs), inflammation of the mucous membrane of the bronchial tubes.

caffeine (kăf′ė-ĭn), an alkaloid obtained from the dried leaves of tea or the dried seeds of coffee, and present in the beverages made from them.

calamine (kăl′ȧ-mīn) **lotion,** a soothing lotion containing zinc oxide and zinc carbonate.

calcium (kăl′sĭ-*ŭ*m), a soft, silver-white metal, occurring only in combination. An important element in the chemical composition of bone.

callus (kăl′*ŭ*s), hard, thickened skin.

calorie (kăl′ȯ-rĭ), a unit of heat. A large calorie is the amount of heat needed to raise the temperature of one kilogram of water one degree centigrade, or four pounds of water one degree Fahrenheit.

cancer (kăn′sẽr), a deadly disease in which a growth of tissue is caused by unlimited multiplication of certain body cells.

canine (kā′nīn), pertaining to the pointed teeth next to the incisors. See **cuspid.**

canker (kăn′kẽr) **sore,** a small sore discharging pus, affecting the mouth and lips.

capillary (kăp′*ĭ*-lĕr′ĭ), one of the fine, thin-walled blood vessels connecting arteries and veins.

carbohydrates (kär′bȯ-hī′drātes), food substances—including sugars, starches, celluloses—which contain carbon, hydrogen, and oxygen in certain proportions.

carbolic (kär-bŏl′ĭk) **acid,** a crystalline substance derived from coal tar. In dilute solution it is used as an antiseptic.

carbon dioxide (kär′bŏn dī-ŏk′sīd), a heavy, colorless gas given off in respiration, decomposition, and oxidation of carbon compounds.

carbon monoxide (kär′bŏn mŏn-ŏk′sīd), a colorless, poisonous gas formed by the combustion of carbon with a limited supply of air.

carbuncle (kär′bŭngk′l), a painful local inflammation of the skin, larger than a boil, which is sometimes fatal.

cardiac muscle (kär′dĭ-ăk mŭs′l), the muscle of the heart.

carrier (kăr′ĭ-ẽr), a person who has the germs of some disease in his body but is not affected by them.

cartilage (kär′t*ĭ*-lĭj), a tough, elastic animal tissue; gristle.

casein (kā′sė-ĭn), protein in milk, the main constituent of curd.

caseous (kā′sė-*ŭ*s), resembling cheese.

cataract (kăt′*ȧ*-răkt), a loss of transparency of the crystalline lens of the eye or its capsule.

catarrh (k*ȧ*-tär′), an inflammatory affection of any mucous membrane.

cathartic (k*ȧ*-thär′tĭk), medicine that cleans the bowels.

caustic potash (kôs′tĭk pŏt′ăsh), an alkali used in the making of soap.

cecum (sē′k*ŭ*m), a sac in which the large intestine begins, situated on the right side in the lower part of the abdomen.

cell, one of the units of protoplasm of which all living things are composed; it consists of a nucleus in a mass of cytoplasm, which is usually enclosed within a cell wall.

cellulose (sĕl′ů-lōs), a carbohydrate, the basis of the cell walls of plants.

centrifugal (sĕn-trĭf′ů-g*ă*l) **force,** a force directed outward when a body is made to move in a curved path.

cerebellum (sĕr′ė-bĕl′*ŭ*m), the part of the brain lying below and behind the cerebrum which co-ordinates movement.

cerebral hemorrhage (sĕr′ė-br*ă*l hĕm′*ŏ*-rĭj), a bleeding of a blood vessel in the brain.

cerebrum (sĕr′ė-br*ŭ*m), the larger part of the brain, occupying the upper part of the skull, which controls voluntary movement and thinking.

character, one of the principal features or qualities of a living thing, as the color, size, form, or structure of its parts.

chest cavity, the space above the diaphragm containing the heart and lungs.

chloral hydrate (klō′r*ă*l hī′drāt), a chemical which when taken into the body induces sleep.

chloride (klō′rīd) **of lime,** a bleaching agent, disinfectant, and deodorant, made by passing chlorine over slaked lime.

chlorine (klō′rēn), a greenish yellow gas of characteristic odor, irritating to the throat and air passages.

chloroform (klō′rȯ-fôrm), a colorless, volatile liquid used as an anesthetic.

cholesterol (kȯ-lĕs′tĕr-ōl), a fatlike substance, found in the blood, bile, egg yolk, and especially in nerve tissue.

choroid (kō′roid), middle coat of eye, between retina and sclera, made up of blood vessels and pigment.

chromatin (krō′mȧ-tĭn), the essential substance of chromosomes and nuclei; so called because it is readily seen in color when dyes are applied to the cells.

chromosome (krō′mȯ-sōm), band or rod made from the chromatin; the chief structure involved in cell division; the carrier of hereditary characters.

chronic (krŏn′ĭk), deep-rooted or lingering.

cilia (sĭl′ĭ-ȧ), hairlike projections of protoplasm from the surface of a cell which, by their movements, cause the cell to move or produce movement in the surrounding medium.

ciliary (sĭl′ĭ-ĕr′ĭ) **muscle,** muscle that controls the shape of the lens of the eye.

circulation (sûr′ku̇-lā′shŭn), movement of the blood in the body.

circulatory (sûr′ku̇-lȧ-tō′rĭ) **system,** the system of organs by means of which the blood is carried through all parts of the body.

cleft palate (klĕft păl′ĭt), a split in the roof of the mouth, existing at birth.

clinic (klĭn′ĭk), an institution devoted to the examination—and often free treatment—of patients.

coagulation (kȯ-ăg′u̇-lā′shŭn), clotting, or the changing of a fluid to a thickened, curdlike state.

cocaine (kō-kān′), a drug extracted from coca leaves, used in medicine to deaden pain.

cochlea (kŏk′lē̇-ȧ), the part, resembling a snail shell, in the inner ear which contains the endings of the auditory nerve.

cold sore, an eruption of tiny blisters about the mouth or nostrils, usually appearing during a cold or fever.

colon (kō′lŏn), the part of the large intestine that extends from the cecum to the rectum.

combustion (kŏm-bŭs′chŭn), burning, or the chemical union of a substance with oxygen, accompanied by light and heat.

communicable disease, a disease that can be transmitted from one person to another.

concave lens, a lens in which one or both sides are curved inward like the inner surface of a sphere so that it is thicker at the edge than in the middle.

conductor (kŏn-dŭk′tẽr), a substance or body which transmits heat or electricity.

congestion (kŏn-jĕs'chŭn), accumulation of blood in an organ, or a part of an organ, in which the blood vessels are overfull.

constipation (kŏn'stĭ-pā'shŭn), a state of the bowels caused by inactivity of the colon, in which food residues become overdry and packed, delaying elimination.

consumption, a bacterial disease in which small lumps develop in the lungs, and the living tissue is destroyed; pulmonary tuberculosis.

contagious (kŏn-tā'jŭs), spreading by contact from one person or animal to another.

convalescent (kŏn'vȧ-lĕs'ĕnt), recovering health after illness.

convex lens, a lens in which one or both sides are curved outward so that it is thicker in the middle than at the edge.

co-ordination (kō̇-ôr'dĭ-nā'shŭn), a working together or harmonious adjustment of parts.

cornea (kôr'nē̇-ȧ), transparent region of the sclera, in the front of the eye.

coronary (kŏr'ō̇-nĕr'ĭ) **artery,** either of the two arteries which supply the tissues of the heart itself.

coronary thrombosis (thrŏm-bō'sĭs), the formation of a clot in a coronary artery.

corpuscle (kôr'pŭs'l), small body, such as a blood cell.

cranial (krā'nĭ-ăl), relating to the skull or cranium or to an organ within the skull, as the brain.

cretin (krē'tĭn), a deformed idiot, whose condition is brought about by a deficiency in the secretion of the thyroid gland.

cross-eyes, condition in which one eye turns toward or away from the other instead of being directed with the other eye toward the object looked at.

crystalline (krĭs'tăl-ĭn) **lens,** a transparent body in the eye directly behind the pupil which brings the light rays to a focus on the retina.

culture (kŭl'tûr) **plate,** a plate containing material for the cultivation of microscopic living things.

cuspid (kŭs'pĭd), a tooth having one point for tearing food; a canine tooth.

cuticle (kū'tĭ-k'l), the outer, hard layer of the skin.

cytoplasm (sī'tō̇-plăz'm), the protoplasm or living substance of a cell outside of its nucleus.

dandruff (dăn'drŭf), small dry scales that form on the scalp.

decomposition (dē′kŏm-pȯ-zĭsh′*ŭ*n), breaking up of a substance into its parts.

deficiency (dė-fĭsh′*ĕ*n-s*ĭ*) **disease,** disease caused by a lack of something that is essential to the body.

deformity (dė-fôr′m*ĭ*-tĭ), a condition which varies from the normal, and is usually applied to abnormality of the skeletal system.

degenerative (dē-jĕn′ĕr-ā′tĭv) **disease,** disease which causes deterioration of vital organs; more or less normal to old age but often occurring prematurely.

deltoid (dĕl′toid), the triangular muscle that covers the shoulder joint, so called because of its resemblance to the Greek letter *delta.*

denatured (dē-nā′t͜ûrd) **alcohol,** alcohol rendered unfit for drinking without destroying its usefulness for other purposes.

dendrite (dĕn′drīt), treelike branches of a nerve cell that receive nerve impulses from the axon.

dentifrice (dĕn′t*ĭ*-frĭs), a preparation for cleaning teeth.

dentine (dĕn′tēn), hard substance below the enamel, forming the greater part of the tooth.

deodorant (dē-ō′dĕr-*ă*nt), a substance which destroys or counteracts a smell.

depilatory (dė-pĭl′*ȧ*-tȯ′rĭ), a preparation for removing hair from the body.

depressant (dė-prĕs′*ă*nt), a substance that depresses nervous or vital activities.

derivative (dė-rĭv′*ȧ*-tĭv), a substance derived from another substance by modification or partial substitution even though not obtainable from it in practice.

dermis (dûr′mĭs), inner layer of skin.

diabetes (dī′*ȧ*-bē′tēz), disease in which the sugar of the body is not completely oxidized or burned, caused by lack of hormone from pancreas.

diagnose (dī′*ă*g-nōs′), to recognize disease from its symptoms.

dialysis (dī-ăl′*ĭ*-sĭs), the separation of certain substances in solution by means of their unequal spreading through a membrane.

diaphragm (dī′*ȧ*-frăm), the dome-shaped sheet of muscle separating the chest cavity from the abdominal cavity; used in breathing.

diarrhea (dī′*ȧ*-rē′*ȧ*), abnormal frequency and liquid condition of bowel movements.

dietary (dī′ĕ-tĕr′ĭ), a systematic arrangement or schedule of diet.

digestion (dĭ-jĕs′chŭn), process by which foods are changed to certain liquids which can be absorbed and used by the cells.

dinitrophenol (dī-nī′trȯ-fē′nōl), a drug formerly used for reducing weight but found in many cases to produce cataract or other complications.

diphtheria (dĭf-thē′rĭ-ȧ), a bacterial disease in which the air passages become coated with a false membrane.

disease, any condition in which there is a departure from health and which presents marked symptoms.

disinfect (dĭs′ĭn-fĕkt′), to destroy disease germs or other harmful microorganisms.

dislocation (dĭs′lȯ-kā′shŭn), displacement of a bone from its normal position in a joint.

distillation (dĭs′tĭ-lā′shŭn), the process of driving off vapor from a liquid by heat and condensing the vapor to a liquid.

dominant (dŏm′ĭ-nănt), pertaining to a character which, if possessed by either of two parents, will appear in the offspring.

ductless glands, glands which pour their secretion directly into the blood.

duodenum (dū′ȯ-dē′nŭm), first part of the small intestine leading from the stomach.

dysentery (dĭs′ĕn-tĕr′ĭ), infectious inflammation of the large intestine with bloody, mucous diarrhea.

eardrum, the tympanum or tympanic membrane of the ear.

eczema (ĕk′zė-mȧ), an inflammatory itching disease of the skin.

efferent (ĕf′ẽr-ĕnt) **nerves,** nerves that carry impulses away from the brain or the spinal cord.

electrocution (ė-lĕk′trȯ-kū′shŭn), being killed by an electric current.

elimination (ė-lĭm′ĭ-nā′shŭn), the act of expelling from the system.

embryo (ĕm′brĭ-ō), plant or animal in its earliest stages of development, before it is fully formed, as a chick within the egg.

emetic (ė-mĕt′ĭk), an agent that induces vomiting.

emulsion (ė-mŭl′shŭn), a liquid mixture in which a fat or oil is suspended in minute globules. Fresh milk is an emulsion.

endemic (ĕn-dĕm′ĭk), peculiar to a district or particular locality.

endocrine (ĕn′dȯ-krīn) **glands.** See **ductless glands.**

environment (ĕn-vī′rŭn-mĕnt), the surroundings.

enzyme (ĕn′zīm), an organic substance which causes such chemical changes as those of digestion and fermentation, without itself being changed.

epidemic (ĕp-ĭ-dĕm′ĭk), a disease or condition which affects a large number of people at once.

epidermis (ĕp′ĭ-dûr′mĭs), outer layer of skin.

epiglottis (ĕp′ĭ-glŏt′ĭs), the tissue which closes the windpipe when anything is swallowed.

epilepsy (ĕp′ĭ-lĕp′sĭ), a chronic disease characterized by loss of consciousness or attacks of convulsion.

epithelial (ĕp′ĭ-thē′lĭ-ăl), of or pertaining to the cellular tissue covering a free surface or lining a tube or cavity of the body.

Epsom (ĕp′sŭm) **salts,** magnesium sulphate, used as a medicine for cleaning the bowels.

equilibrium (ē′kwĭ-lĭb′rĭ-ŭm), a state of control of the body; balance.

ergosterol (ẽr-gŏs′tẽr-ōl), vitamin D, or the principle in foods and in the body which, when exposed to ultraviolet radiation, prevents or cures rickets.

esophagus (ė-sŏf′ȧ-gŭs), the portion of the alimentary canal leading from the throat to the stomach; the gullet.

ether (ē′thẽr), a liquid used to produce general anesthesia by inhalation. It is also used as a solvent.

ethyl alcohol (ĕth′ĭl ăl′kȯ-hôl), a liquid formed by fermentation of sugar, used as a solvent and in intoxicating beverages; grain alcohol.

eugenics (ū̇-jĕn′ĭks), the science of improving the human race by improving heredity.

Eustachian (ū̇-stā′kĭ-ăn) **tube,** the tube which leads from the middle ear to the throat.

evaporation, changing of a liquid to a gas.

excreta (ĕks-krē′tȧ), waste matter given off from the body; excretions.

excretory (ĕks′krė-tō′rĭ) **duct,** a duct discharging waste products, as sweat.

exhalation (ĕks′hȧ-lā′shŭn), breathing out; expiration.

eyestrain, weariness or strained condition of the eye from overuse or uncorrected defects of vision.

fainting, loss of consciousness caused by sudden reduction of the brain's blood supply.

farsightedness, a condition of the eye in which vision for distant objects (though not as good as in the normal eye) is better than for near objects; hyperopia.

fatigue (fȧ-tēg′), weariness resulting from work or physical exercise; bodily or mental exhaustion.

fatty acids, acids formed during the digestion of fats.

feces (fē′sēz), the intestinal wastes of animals.

feeble-minded, lacking in normal intelligence.

fermentation (fûr′mĕn-tā′shŭn), a chemical change such as that by which yeast changes sugar into carbon dioxide and alcohol.

fever, a temperature of the human body exceeding 98.6 degrees Fahrenheit.

fever blister. See **cold sore.**

fiber (fī′bẽr), slender, threadlike structure forming certain organic tissues.

fibrinogen (fī-brĭn′ō-jĕn), protein material in the blood which, when exposed to air, forms the threadlike fibers of the clot.

fibrous (fī′brŭs), consisting of fibers, threads, or threadlike material.

filter (fĭl′tẽr), any porous material through which a liquid is passed to remove solid particles or impurities.

filterable virus (fĭl′tẽr-ȧ-b'l vī′rŭs), a virus whose infective elements are so small that they will pass through a porcelain filter.

focus, point where two converging rays of light meet.

focusing muscle, a muscle that controls the shape of the lens of the eye so as to bring light rays from a given point to a focus on the retina.

follicle (fŏl′ĭ-k'l), a tiny cavity, sac, or tube.

formaldehyde (fôr-măl′dė-hīd), an irritating, poisonous gas used as a disinfectant.

fracture (frăk′tûr), a broken bone.

function, use or work of an organ.

fungus (fŭng′gŭs), a plant without chlorophyll (green color) that derives its nourishment entirely from organic compounds.

gall bladder, small sac in which bile from the liver is stored temporarily.

ganglia (găng′glĭ-*ȧ*), plural of **ganglion.**

ganglion (găng′glĭ-*ŭ*n), a mass or group of nerve cells.

gastric (găs′trĭk) **juice,** a digestive fluid secreted by the glands of the stomach.

generation (jĕn′ẽr-ā′sh*ŭ*n), average lifetime of man, about 33 years.

genes (jēns), small particles of a chromosome that have the power to produce definite traits in the offspring.

germicide (jûr′m*ĭ*-sīd), any substance that destroys disease germs.

germs (jûrms), microorganisms, either bacteria or protozoans, that cause disease.

giantism (jī′*ă*nt-ĭz'm), a condition in which the body develops abnormally from excessive growth of long bones caused by overactivity of the pituitary gland.

gland, a secreting organ which separates and elaborates fluid from the blood.

glomerulus (glō̇-mĕr′ū̇-l*ŭ*s), a tuft of capillary loops at the beginning of each tubule in the kidneys.

glycogen (glī′kō̇-jĕn), a form of carbohydrate, known as animal starch, stored in the liver.

goiter (goi′tẽr), an enlargement of the thyroid gland, causing a swelling in the front of the neck.

grain alcohol. See **ethyl alcohol.**

gray matter, gray nerve tissue in the brain and spinal cord, composed of nerve cells and fibers.

gristle (grĭs′l). See **cartilage.**

groin (groin), the fold marking the line between the lower part of the abdomen and the thigh.

hay fever, an inflammatory affection of the mucous membranes of the eyes and respiratory tract, usually occurring in spring or late summer.

heart, a hollow, muscular organ which, by contracting rhythmically, keeps up the circulation of the blood.

heartburn, a burning sensation about the heart, caused by a flowing back of acid from the stomach into the esophagus.

hemoglobin (hē′mō̇-glō′bĭn), the iron compound in the red blood corpuscles, which unites with oxygen.

hemophilia (hē′mȯ-fĭl′ĭ-ȧ), a tendency, usually hereditary, to profuse bleeding, even from very slight wounds.

hemorrhage (hĕm′ŏ-rĭj), any discharge of blood from the blood vessels.

heredity (hė-rĕd′ĭ-tĭ), the passing on of qualities or traits of the parents to their offspring.

hibernate (hī′bẽr-nāt), to pass the winter in a dormant condition.

hives (hīvz), an inflammatory disease of the skin accompanied by intense itching.

hormone (hôr′mōn), a chemical substance produced by a ductless gland that passes directly into the blood and controls the activity of some organ of the body.

humidity (hů-mĭd′ĭ-tĭ), moisture in the atmosphere. The percentage of moisture in the air is called relative humidity.

hybrid (hī′brĭd), the offspring of two parents that are considerably unlike in some of their hereditary characters.

hydrochloric (hī′drȯ-klō′rĭk) **acid,** colorless acid, occurring in the gastric juice in .2 to .4 percent.

hydrogen peroxide (hī′drȯ-jĕn pẽr-ŏk′sīd), a chemical used as an antiseptic when dissolved in water.

hyperopia (hī′pẽr-ō′pĭ-ȧ). See **farsightedness.**

hypersensitivity (hī′pẽr-sĕn′sĭ-tĭv′ĭ-tĭ), being excessively susceptible.

hypodermic (hī′pȯ-dûr′mĭk), injection under the epidermis.

idiosyncrasy (ĭd′ĭ-ȯ-sĭng′krȧ-sĭ), a peculiarity of constitution.

idiot (ĭd′ĭ-ŭt), a person born lacking intelligence due to incomplete development of the brain.

immunity (ĭ-mū′nĭ-tĭ), condition in which an individual does not develop disease even when the causative organism is present.

impetigo (ĭm′pė-tī′gō), a contagious disease in which the skin becomes covered with blisters filled with pus.

impulse (ĭm′pŭls), the change which travels like a wave along a nerve fiber when it is stimulated and is responsible for sensation or motion.

incineration (ĭn-sĭn′ẽr-ā′shŭn), burning to ashes.

incisors (ĭn-sī′zẽrs), the teeth in front of the canines adapted for cutting. Man has eight incisors.

incubation (ĭn′kū̇-bā′shŭn), development of an infectious disease up to the appearance of the symptoms.

indigestion (ĭn′dĭ-jĕs′chŭn), incomplete or difficult digestion.

infantile paralysis (ĭn′făn-tīl pȧ-răl′ĭ-sĭs), acute inflammation of the anterior horns of the gray matter of the spinal cord resulting in paralysis of the motor nerves and often producing deformities; poliomyelitis.

infection (ĭn-fĕk′shŭn), a condition due to microorganisms within the body multiplying and producing toxins.

infectious (ĭn-fĕk′shŭs), communicable or caused by infection.

inferiority (ĭn-fē′rĭ-ŏr′ĭ-tĭ) **complex,** a morbid sense of personal inferiority, resulting in timidity or exaggerated aggressiveness.

inflammation (ĭn′flă-mā′shŭn), a painful redness and swelling due to congestion of blood vessels.

influenza (ĭn′flo͝o-ĕn′zȧ), an acute inflammation of the nasal passages accompanied by fever; sometimes epidemic.

infrared (ĭn′frȧ-rĕd′) **rays,** invisible rays of light lying beyond the red end of the visible spectrum.

inhalation (ĭn′hȧ-lā′shŭn), act of drawing air into the lungs; inspiration.

inheritance (ĭn-hĕr′ĭ-tăns), that which is or may be inherited.

inhibition (ĭn′hĭ-bĭsh′ŭn), restraint of the action of an organ.

inoculation (ĭn-ŏk′ū̇-lā′shŭn), introduction through the skin of material containing germs or toxins of a given disease in order to develop immunity to that disease.

inorganic (ĭn′ôr-găn′ĭk), term applied to material nonliving in origin.

insoluble (ĭn-sŏl′ū̇-b’l), incapable of being dissolved in a liquid.

insomnia (ĭn-sŏm′nĭ-ȧ), sleeplessness.

inspiration (ĭn′spĭ-rā′shŭn), act of filling the lungs with air.

instinct (ĭn′stĭngkt), an inherited involuntary response to a stimulus.

insulin (ĭn′sū̇-lĭn), hormone made in the pancreas; regulates use of sugar in the body.

intercostal (ĭn′tẽr-kŏs′tăl) **breathing,** breathing by means of the muscles between the ribs.

internal secretion, secretion produced by a ductless gland.

intestine (ĭn-tĕs′tĭn), tubular portion of the alimentary canal following the stomach; the bowels.

involuntary (ĭn-vŏl′ŭn-tĕr′ĭ), not under the influence or control of the will.

iodine (ī′ȯ-dīn), chemical element, necessary to the proper functioning of thyroid glands. In solution, used as a test for starch; in greater strength, as a disinfectant.

iris (ī′rĭs), colored part of the eye surrounding the pupil.

irritant (ĭr′ĭ-tănt), that which excites to action.

irritation (ĭr′ĭ-tā′shŭn), a condition of oversensitiveness of an organ or part of the body.

itch, an itching disease of the skin caused by an animal parasite.

joint, the place where two bones come together, usually moving upon each other.

kidneys (kĭd′nĭz), two bean-shaped organs in abdominal cavity which excrete urine.

lacrimal (lăk′rĭ-măl), pertaining to tears.

lactic (lăk′tĭk) **acid,** acid formed in the souring of milk.

larynx (lăr′ĭngks), part of the windpipe where the voice is produced; voice box.

laxative (lăk′sȧ-tĭv), anything that causes looseness of the bowels.

lens, transparent object with one or two curved surfaces. Rays of light passing through it are bent.

lesion (lē′zhŭn), a diseased or injured region.

ligament (lĭg′ȧ-mĕnt), a band or sheet of fibrous tissue connecting two or more bones or cartilages.

liver, a large gland located on the right side of the body between the diaphragm and the stomach. It secretes a liquid called bile.

longevity (lŏn-jĕv′ĭ-tĭ), length of life.

lymph (lĭmf), a nearly colorless fluid, contained in the lymphatics, consisting of blood plasma and colorless corpuscles.

lymph nodes, bodies scattered along the lymphatic vessels in which the lymph is purified.

lymphatic (lĭm-făt′ĭk), tube carrying lymph back into the blood stream.

lymphoid (lĭm′foid), pertaining to tissue in the lymph glands.

malnutrition (măl′nû-trĭsh′ŭn), faulty nutrition.

marijuana (mä′rė-hwä′nä), Mexican term for the dried leaves and flowers of hemp which are smoked in cigarettes and which contain a habit-forming drug.

marrow (măr′ō), soft tissue which fills the cavities of most bones.

mastication (măs′t*ĭ*-kā′sh*ŭ*n), chewing.

mastoid (măs′toid), bony prominence behind the ear.

maxillary (măk′s*ĭ*-lĕr′ĭ), pertaining to the jawbone.

medulla (mė-dŭl′*ȧ*), the extreme upper part of the spinal cord, forming the connection between the cord and the brain; spinal bulb.

membrane (mĕm′brān), a thin, sheetlike layer composed of epithelial cells, serving to line a cavity or tube.

meridian (m*ĕ*-rĭd′ĭ-*ă*n), circle passing through the poles and any place on the earth's surface; the half of such circle included between the poles.

metabolism (mė-tăb′ȯ-lĭz′m), all chemical change in living plants or animals, including building-up processes and breaking-down processes.

methyl (mĕth′*ĭ*l) **alcohol.** See **wood alcohol.**

microbe (mī′krōb), a microscopic plant or animal organism; germ.

microorganism (mī′krȯ-ôr′g*ă*n-ĭz′m), any organism of microscopic size; applied especially to bacteria and protozoa.

molar (mō′lẽr), back tooth with broad surface, adapted for grinding. Man has twelve molar teeth.

mold, any fungus producing a woolly growth on damp or decaying organic matter.

morphine (môr′fēn), a derivative of opium, a narcotic.

motor nerve, nerve that carries impulses that result in movement of a muscle or activity of an organ.

mucus (mū′k*ŭ*s), a watery secretion from the mucous glands.

mumps, an infection of the salivary glands.

muscle tone, slightly contracted condition of a muscle.

myopia (mī-ō′pĭ-*ȧ*). See **nearsightedness.**

myxedema (mĭk′sė-dē′m*ȧ*), a diseased condition of the skin in an adult due to deficiency of thyroid secretion.

narcotic (när-kŏt′ĭk), a sleep-producing drug.

nausea (nô′shė-*ȧ*), a feeling of a need to vomit.

nearsightedness, seeing distinctly at short distances only; myopia.

negative report, report that the condition looked for is absent.

nephritis (nė-frī′tĭs), inflammation of the kidneys; Bright's disease.

nerve, cordlike bands of nervous tissue that connect parts of the nervous system and conduct nervous impulses to and away from these parts.

nerve fiber, protoplasmic extension (axon or dendrite) of a nerve cell forming a nerve.

neuromuscular (nū'rȯ-mŭs′ku̇-lẽr), pertaining to nerves and muscles.

neuron (nŭ′rŏn), a nerve cell and its dendrites and axon.

neutral substance, a substance that is neither acid nor alkaline.

neutralize (nū′tr*ă*l-īz), to counteract or render incapable of further chemical action.

nitrogen (nī′trȯ-jĕn), an inert chemical element found in air, in protein, and in protoplasm.

nucleus (nū′klė-*ŭ*s), a small round or oval body within the protoplasm of a cell that controls the activity of the cell.

nutrition (nu̇-trĭsh′*ŭ*n), processes by which an animal or plant takes in, absorbs, and utilizes food substances.

obesity (ȯ-bēs′*ĭ*-tĭ), a condition of abnormal fatness.

occlusion (*ŏ*-klo͞o′zh*ŭ*n), shutting or closing a passage; bringing the opposing surfaces of the teeth of the two jaws into contact.

oculist (ŏk′u̇-lĭst), a specialist in diseases of the eye.

oil glands, glands that secrete fat or oil; sebaceous glands.

ointment, a soft, greasy substance which melts when smeared on the skin.

ophthalmologist (ŏf'thăl-mŏl′ȯ-jĭst), a physician specializing in the study and treatment of defects and diseases of the eye; an oculist.

opium (ō′pĭ-ŭm), a powerful narcotic derived from the unripe capsules of the poppy.

opsonin (ŏp′sȯ-nĭn), a substance in the blood serum that affects invading bacteria in such a way that white corpuscles can destroy a larger number of them.

optic (ŏp′tĭk) **nerve,** nerve of sight, carrying impulses from the retina of the eye to the brain.

optician (ŏp-tĭsh′*ă*n), one who makes or deals in optical glasses and instruments.

optometrist (ŏp-tŏm′ė-trĭst), one who measures the range or powers of vision in the selection of eyeglasses.

organ (ôr′g*ă*n), a part of the body that has a special work or function to perform.

organic (ŏr-găn′ĭk), a term applied to living things or to material produced by living things; term also applied to matter containing carbon.

organism (ôr′g*ă*n-ĭz’m), a body composed of different parts or organs more or less separate in function but mutually dependent and essential to life; any living being.

oxidation (ŏk′s*ĭ*-dā′sh*ŭ*n), chemical union of oxygen with some substance.

oxygen (ŏk′s*ĭ*-j*ĕ*n), one of the most abundant chemical elements. A colorless gas occurring in air and combining readily with other substances.

palate (păl′ĭt), roof of the mouth.

pancreas (păn′krė-*ă*s), digestive gland lying below the stomach.

pancreatic (păng′krė-ăt′ĭk) **juice,** digestive fluid secreted by the pancreas.

pandemic (păn-dĕm′ĭk), affecting the majority of people in a country or a number of countries.

papilla (p*ȧ*-pĭl′*ȧ*), small nipplelike projection or part containing blood vessels and nerve endings.

papillae (p*ȧ*-pĭl′ē), plural of **papilla.**

paralysis (p*ȧ*-răl′*ĭ*-sĭs), loss of power of voluntary motion or of sensation in any part of the body.

parasite (păr′*ȧ*-sīt), plant or animal living in or on another plant or animal at whose expense it is maintained.

pasteurize (pȧs′tẽr-īz), to heat milk from 140°-155° F. for at least 20 minutes in order to destroy harmful bacteria.

pathogenic (păth′ȯ-jĕn′ĭk), causing disease.

pellagra (p*ĕ*-lā′gr*ȧ*), a skin disease, resulting from a faulty diet, which seriously disturbs the nervous system.

pelvis (pĕl′vĭs), the basin-shaped, bony hip girdle supporting the spinal column, resting on the lower extremities.

penicillin (pĕn-ĭ-cĭl′lĭn), a potent new drug, an extract of a mold used in the treatment of many kinds of common infections.

pericardium (pĕr′ĭ-kär′dĭ-*ŭ*m), double walled sac around the heart.

peristalsis (pĕr′ĭ-stăl′sĭs), the wavelike motion that forces the food through the intestines, stomach, and esophagus due to the contraction of the muscles of these organs.

perspiration (pûr′sp*ĭ*-rā′sh*ŭ*n), secretion of the sweat glands; sweat.

pharynx (făr′ĭngks), the region or cavity at the back part of the mouth through which air passes to the windpipe, and food and drink to the esophagus.

phenolphthalein (fē′nōl-thăl′ēn), a substance used as an indicator in chemical analysis; also used as a laxative.

phosphorus (fŏs′fȯ-r*ŭ*s), chemical element necessary for protein and protoplasm.

pinkeye (pĭngk′ī), an acute, contagious inflammation of the lining of the eyelids, marked by redness of the eyeball.

pituitary (pĭ-tū′ĭ-tĕr′ĭ) **gland,** a ductless gland projecting from the lower side of the brain.

plasma (plăz′m*ȧ*), liquid part of the blood.

plastic surgery (plăs′tĭk sûr′jĕr-ĭ), surgery to reconstruct deformed or disfigured parts.

platelets (plāt′lĕts), colorless disks in the blood, smaller than either the red or white corpuscles, important in the clotting of the blood.

pleura (plo͝o′r*ȧ*), membrane covering the lungs and lining the chest cavity.

pleurisy (plo͝or′*ĭ*-sĭ), inflammation of the pleura.

pneumococcus (nū′mȯ-kŏk′*ŭ*s), the bacterium which causes an acute type of pneumonia.

pneumonia (nû-mō′nĭ-*ȧ*), an inflammation of the lungs.

poison, any substance which, introduced into the living body, destroys life or health.

polio [poliomyelitis (pŏl′ĭ-ȯ-mī′*ĕ*-lī′tĭs)]. See **infantile paralysis.**

pollen (pŏl′*ĕ*n), fine, yellow powder produced on stamens of a flower. Important in the formation of the seed.

pore, tiny hole in the skin through which perspiration escapes.

portal (pōr′t*ă*l), applied to the circulation of the blood from the digestive organs through the liver.

positive report, report that the condition looked for is present.

posture (pŏs′tṳr), the position or the bearing of the body as a whole.

poultice (pōl′tĭs), a soft mixture, usually moist and warm, applied like a plaster to a sore or inflamed part of the body.

prescription (prė-skrĭp′sh*ŭ*n), a written direction for the preparation and administration of a remedy.

protein (prō′tė-ĭn), a complex chemical compound containing nitrogen and other elements in addition to carbon, hydrogen, and oxygen; the basis of protoplasm.

protoplasm (prō′tō̇-plăz′m), a semiliquid substance, the living part of plant and animal cells.

protozoan (prō′tō̇-zō′*ă*n), a one-celled microscopic animal.

ptyalin (tī′*ȧ*-lĭn), enzyme in saliva that changes starch to sugar.

pulmonary (pŭl′mō̇-nĕr′ĭ), related to the lungs.

pulmonary tuberculosis (tū̇-bûr′kū̇-lō′sĭs). See **consumption.**

pulp cavity, the central part of the tooth containing nerves and blood vessels.

pulse, regular beating or throbbing in the arteries caused by the contraction of the ventricles of the heart.

pupil, the opening in the iris of the eye through which rays of light pass to the retina.

pus, a yellowish-white matter containing bacteria and the remains of white corpuscles.

pustule (pŭs′tū̇l), a small elevation of the skin with an inflamed base, containing pus.

putrefaction (pū′trė-făk′sh*ŭ*n), process of decay, usually characterized by disagreeable odors.

pyorrhea (pī′ŏ-rē′*ȧ*), a disease of the gums in which the teeth are loosened, and pus is discharged from the gums.

quack, a person who pretends to have medical skill and knowledge of marvelous remedies.

quarantine (kwŏr′*ă*n-tēn), enforced isolation for a fixed period of time (originally forty days) of persons infected with communicable disease.

radiation (rā′dĭ-ā′sh*ŭ*n), spreading in all directions from a center.

radium (rā′dĭ-*ŭ*m), a rare metallic element which gives off invisibl and extraordinarily energetic particles.

rationalization (răsh′*ŭ*n-*ă*l-ĭ-zā′sh*ŭ*n), plausible or apparently reasonable explanation for one's actions or mental attitudes without frank acknowledgment of the real motive.

reaction (rė-ăk′sh*ŭ*n), response of an organism to some change in its environment, or the mental or emotional state induced by a situation.

recessive (rė-sĕs′ĭv), pertaining to a character which is obscured in the offspring by a dominant character but which can be transmitted to a later generation.

rectum (rĕk′t*ŭ*m), lower end of the large intestine.

reflex (rē′flĕks) **action,** bodily action controlled by spinal nerve centers without conscious direction from the brain.

regenerate (rė-jĕn′ẽr-āt), to replace an injured or missing part.

relative humidity. See **humidity.**

relax, to loosen or lessen tension.

reproduction (rē′prȯ-dŭk′sh*ŭ*n), the process by which plants and animals produce offspring.

resistance, the act or capacity of opposing.

resonant (rĕz′ȯ-n*ă*nt), intensified and enriched by the vibrating quality of a voice sound.

respiration (rĕs′p*ĭ*-rā′sh*ŭ*n), process by which oxygen is taken into, and carbon dioxide is given off from, the cells.

response (rė-spŏns′), reaction to a stimulus.

resuscitation (rė-sŭs′*ĭ*-tā′sh*ŭ*n), act of restoring to consciousness or life.

retina (rĕt′ĭ-n*ȧ*), the innermost layer of the eyeball, formed by the branched endings of the optic nerve.

rickets (rĭk′ĕts), disease of children caused by insufficient calcium in the food, and resulting in soft, curving bones.

ringworm, skin disease caused by a mold.

roughage (rŭf′ĭj), coarse food containing indigestible material, such as cellulose, whose bulk stimulates peristalsis in the intestines.

rupture (rŭp′t͜u̇r), a forcible tearing or breaking of a part.

saliva (s*ȧ*-lī′v*ȧ*), digestive juice secreted by salivary glands, active chiefly in the mouth.

sanitation (săn̩′*ĭ*-tā′sh*ŭ*n), use of measures for improving conditions that influence health.

scabies (skā′bĭ-ēz), the itch.

scapula (skăp′u̇-l*ȧ*), shoulder blade.

Schick (shĭk) **test,** test used to find out whether a person is immune to diphtheria.

sclera (sklē′r*ȧ*), white outside coat of the eyeball.

scurvy (skûr′vĭ), disease caused by a diet deficient in vitamin C, characterized by discolored spots, spongy gums, and bleeding from the mucous membranes.

secretion (sē̇-krē′shŭn), substance given off by a cell or group of cells differing in properties from the material from which it is produced.

sebaceous (sē̇-bā′shŭs) **glands.** See **oil glands.**

sedative (sĕd′ȧ-tĭv), anything that quiets irritation or lessens pain.

sediment (sĕd′ĭ-mĕnt), the matter which settles to the bottom from a liquid.

segment (sĕg′mĕnt), any one of the parts into which a body is divided.

semicircular (sĕm′ĭ-sûr′kū̇-lẽr) **canals,** loop-shaped tubes in the inner ear.

sensation (sĕn-sā′shŭn), being conscious of an external stimulus, as sensation of color caused by action of light on retina of eye which results in impulses affecting brain cells.

sensitive (sĕn′sĭ-tĭv), having sense or feeling; capable of receiving impressions from external objects.

sensory (sĕn′sō̇-rĭ) **end plate,** end of a sensory nerve which receives a stimulus.

septic sore throat, a sore throat with severe systemic infection due to streptococci in the general circulation.

serum (sē′rŭm), plasma of the blood without fibrinogen, the liquid left after the blood has clotted; also may mean the material used for immunizing purposes.

sinus (sī′nŭs), a hollow space in a bone or other tissue; one of the cavities connecting with the nose.

skull, skeleton or framework of the head.

solution (sō̇-lū′shŭn), dissolving a solid, liquid, or gaseous substance in a liquid.

solvent (sŏl′vĕnt), any liquid in which a substance can be dissolved.

spectrum (spĕk′trŭm), a series of colors, resembling the rainbow, produced by separating white light into different wave lengths.

sperm (spûrm), reproductive cell produced by the male animal.

sphenoid (sfē′noid), applied to the wedge-shaped bone in the skull at the base of the brain.

sphenoidal (sfē̇-noi′dăl), pertaining to a sinus within the sphenoid bone at the base of the cranium.

spinal bulb, enlargement of spinal cord located at the base of the brain; medulla.

spinal column, a series of similar bones, joined by cartilage, giving a strong, flexible support for the body; backbone.

spinal cord, cord of nerve tissue lying in a canal in the spinal column.

spleen (splēn), a ductless gland situated at the left of the stomach.

spore (spōr), a cell, produced by plants and some protozoans, capable of growing into a new individual.

sprain, injury to a joint with tearing or separation of ligaments.

sputum (spū′t*ŭ*m), expectorated matter characteristic of diseases of the respiratory tract.

sterilization (stĕr′*ĭ*-lĭ-zā′sh*ŭ*n), process by which all living bacteria are destroyed by heat or by chemicals.

stethoscope (stĕth′ō̇-skōp), an instrument for examining the heart, lungs, and other organs of the body by listening to the sounds produced by them.

stimulant (stĭm′ū̇-l*ă*nt), a substance, force, or condition that excites action in the body by acting on the nerves in the skin or by entering the circulation.

stimulus (stĭm′ū̇-l*ŭ*s), anything that starts the activity of a nerve (impulse) or produces an impression on a sensory organ.

stomach (stŭm′*ă*k), an enlargement of the alimentary canal that serves to hold food while it is being acted upon by digestive juices.

strain, undue stretching of a muscle or ligament.

streptococci (strĕp′tō̇-kŏk′sī), plural of **streptococcus.**

streptococcus (strĕp′tō̇-kŏk′*ŭ*s), one of the ball-shaped bacteria, which arrange themselves in chains or strings.

streptomycin (strĕp-tō-mī′cĭn), a new drug, an extract of a mold, used in the treatment of several common infections.

strychnine (strĭk′nĭn), poisonous substance from various plants, used as a nerve and heart stimulant.

sulfanilamide (sŭl′f*ȧ*-nĭl′*ȧ*-mīd), a drug effective against certain pus-forming bacteria.

suprarenal (sū′pr*ȧ*-rē′n*ă*l) **gland.** See **adrenal gland.**

susceptible (s*ŭ*-sĕp′t*ĭ*-b’l), having little resistance to a disease.

sweat glands, glands that give off moisture through the pores of the skin.

symptom (sĭmp′t*ŭ*m), a sign or indication that serves to point out the existence of some condition or disease.

synapse (sĭ-năps′), a place of meeting of the dendrites of one neuron with the ends of the dendrites of another neuron.

synthetic barbiturate (sĭn-thĕt′ĭk bär′bĭ-tū′rāt), habit-forming drug derived from barbituric acid, used in medicine to induce sleep.

systemic (sĭs-tĕm′ĭk), pertaining to the bodily system as a whole.

tapeworm, parasitic worm that lives when adult in the intestine of man and some animals.

tartar (tär′tẽr), a mineral deposit on the teeth.

taste buds, the end organs of taste located in the tongue.

tear gland, gland that secretes watery liquid to moisten the eye.

temperature (tĕm′pẽr-ȧ-t͝ūr), the degree of heat of the human body; sometimes refers to the excess over the normal temperature.

tendon, cord of connective tissue terminating the fleshy part of a muscle and binding it to a bone; sinew.

thorax (thō′răks), that part of the body between the neck and the abdomen enclosed by the spinal column, breastbone, and ribs.

thyroid (thī′roid) **gland,** ductless gland in the neck, lying on each side of the windpipe, which secretes a hormone that regulates the rate of metabolism.

tibia (tĭb′ĭ-ȧ), one of two bones between the knee and ankle.

tissue (tĭsh′ū), a group of cells of one kind, forming a continuous mass or layer.

tonsil, mass of lymphoid tissue on each side of the throat near the base of the tongue.

tonsillitis (tŏn′sĭ-lī′tĭs), inflammation of the tonsils.

tourniquet (t͝oor′nĭ-kĕt), a device or bandage which, when properly placed and twisted tight, controls the flow of blood and stops bleeding.

toxic (tŏk′sĭk), poisonous.

toxin (tŏk′sĭn), poison produced by bacteria and capable of causing disease.

toxin-antitoxin, material injected in a person to develop immunity to diphtheria.

toxoid (tŏk′soid), a modified toxin used for producing immunity to diphtheria.

trachea (trā′kē-ȧ), air tube between larynx and bronchi; windpipe.

trachoma (trȧ-kō′mȧ), a contagious inflammation of the mucous membrane lining of the eyelids.

transfusion (trăns-fū′zh*ŭ*n), transferring blood from the blood vessels of one person to those of another.

trench mouth, a contagious disease of the gums.

triceps (trī′sĕps), a muscle at the back of the upper arm.

Trichinella (trĭk′ĭ-nĕl′*ȧ*), name of a group of animals to which the parasitic worm, commonly called trichina, belongs. This worm may be present in the immature stage in the muscles of man, the hog, and many other animals.

tubercle (tū′bẽr-k’l), small lump on the skin or in the soft tissues of the body.

tuberculin (tu̇-bûr′ku̇-lĭn) **test,** a test for determining the existence of tuberculosis.

tuberculosis (tu̇-bûr′ku̇-lō′sĭs), a disease caused by *Bacillus tuberculosis,* forming tubercles in any part of the body.

tubule (tū′būl), a little tube.

tympanic (tĭm-păn′ĭk) **membrane,** membrane like the head of a drum between outer and middle ear; eardrum.

typhoid (tī′foid) **fever,** a disease caused by *Bacillus typhosus.* The germ enters the body through water, milk, or food that has been contaminated by a person suffering from the disease.

ulcer (ŭl′sẽr), an open sore on any skin or mucous surface of the body, often secreting pus.

ulna (ŭl′n*ȧ*), one of the two bones in the forearm.

ultraviolet (ŭl′tr*ȧ*-vī′ȯ-lĕt) **rays,** light rays, lying beyond the violet end of the spectrum, too rapid for human eyes to see.

urea (u̇-rē′*ȧ*), compound containing nitrogen, found in urine.

ureter (u̇-rē′tẽr), tube through which urine passes from a kidney to the bladder.

urination (ū′r*ĭ*-nā′sh*ŭ*n), passing urine.

urine (ū′rĭn), fluid secreted by the kidneys, stored in the bladder, cast off as waste from the body.

uvula (ū′vu̇-l*ȧ*), small, fleshy projection hanging from the soft palate above the back part of the tongue.

vaccination (văk′sĭ-nā′sh*ŭ*n), the process of developing in man immunity to a disease by introducing the dead germs or the germs of a less severe related disease.

vaccine (văk'sēn), inoculating material originally taken from the cow, now including any inoculating material for the prevention of disease.

valve (vălv), a fold in the wall of a blood vessel, canal, or other organ which allows the contents to flow in one direction only.

valvular (văl'vū̇-lẽr) **heart disease,** a disease pertaining to the valves of the heart.

varicose (văr'ĭ-kōs) **veins,** unnaturally swollen and twisted veins.

vein (vān), blood vessel that carries blood to the heart.

ventral (vĕn'trăl), refers to the side of the body opposite to the back.

ventricle (vĕn'trĭ-k'l), either of the two lower chambers of the heart having muscular walls.

vermiform (vûr'mĭ-fôrm) **appendix.** See **appendix.**

veronal (vĕr'ȯ-năl), trade name applied to a hypnotic drug derived from barbituric acid.

vertebra (vûr'tė-brȧ), any one of the single bones of the spinal column.

vertebrae (vûr'tė-brē), plural form of **vertebra.**

villi (vĭl'ī), plural form of **villus.**

villus (vĭl'ŭs), small fingerlike projection on the mucous membrane of the small intestine, increasing the absorbing surface.

virus (vī'rŭs) **disease,** any disease caused by a filterable virus.

vital organs, organs that are necessary to life.

vitamin (vī'tȧ-mĭn), any of a group of substances occurring in many foods, essential to the proper functioning of the body.

vitreous (vĭt'rė-ŭs) **humor,** transparent, jellylike substance filling the eyeball between the lens and the retina.

vocal cords, folds of mucous membrane which project into the cavity of the voice box.

voice box. See **larynx.**

volatile (vŏl'ȧ-tĭl) **oil,** an oil that evaporates easily.

voluntary (vŏl'ŭn-tĕr'ĭ) **muscle,** muscle regulated or controlled by the will.

white corpuscle, colorless body in the blood, irregular in shape, possessing the power of movement and ability to destroy disease germs.

whooping cough, an infectious disease with spasmodic coughing followed by long, shrill inhalation.

windpipe. See **trachea.**

wisdom teeth, third molars or extreme back teeth on each side of the jaw.

wood alcohol, poisonous alcohol obtained from the distillation of wood; methyl alcohol.

X ray, a ray of very short wave length, capable of penetrating many substances ordinarily opaque; used in medical diagnosis and treatment of certain diseases.

yellow fever, an infectious disease caused by a protozoan, transmitted to man by the bite of a certain type of mosquito.

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